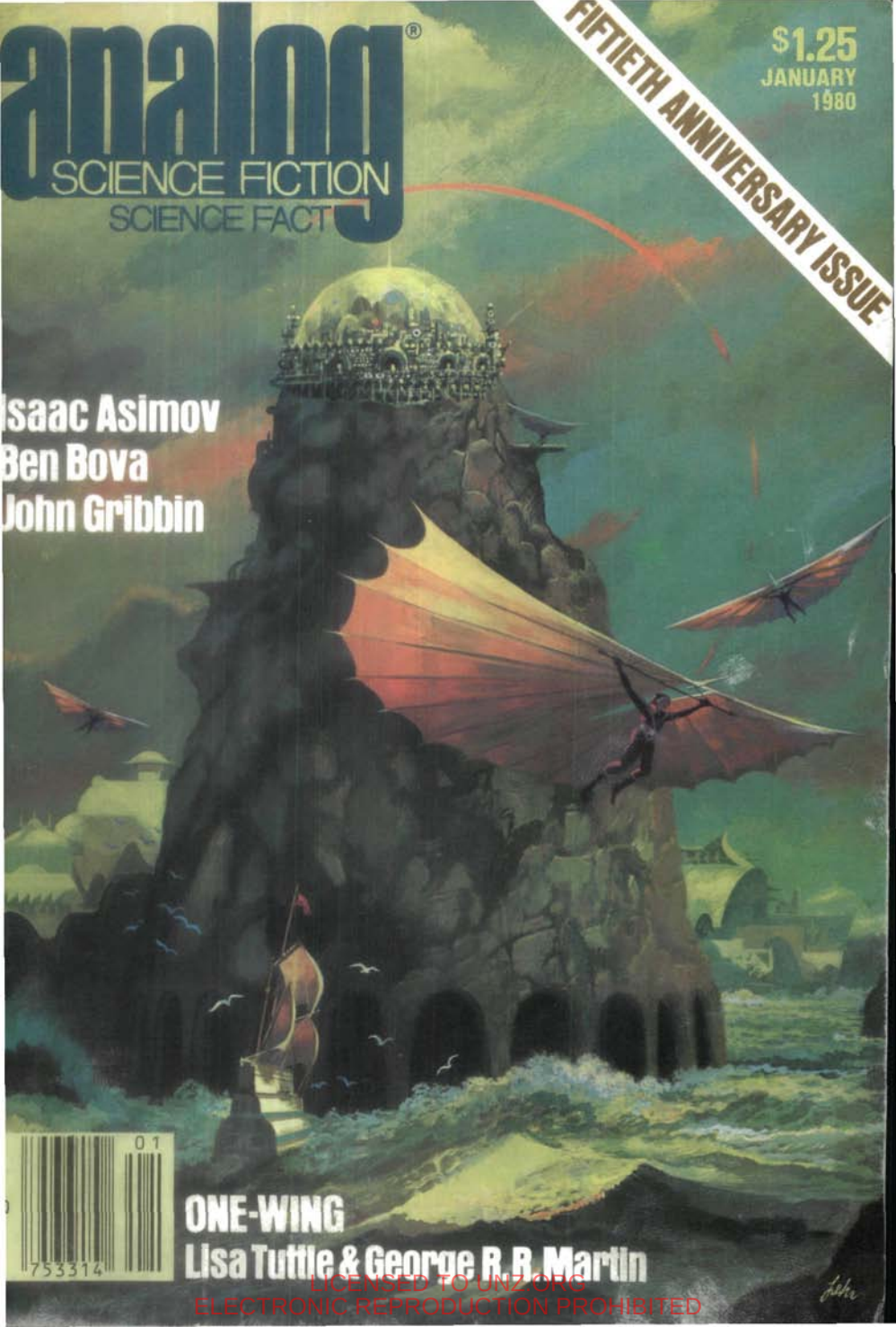

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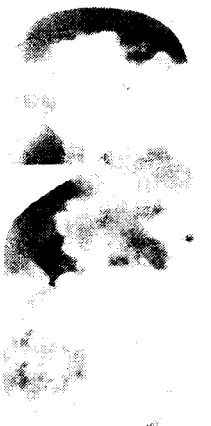

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LOOKING backward AND forward

With this issue, Analog is fifty years old—an occasion we mark with a variety of special features, notably a series of new works by some of the most important contributors to those fifty years, in this issue and throughout the coming year.

Analog, including its earlier incarnations as "Astounding," is a good deal older than I am, so I missed a majority of those issues when they were fresh on the newsstand. Nevertheless, I have some personal familiarity with the magazine through most of its history. I am a third-generation reader. Unlike many readers, who entered science fiction surreptitiously and over the protests of their parents, I was introduced to it by my father—an act for which I shall always be grateful. And I still have several issues from the first decade of Astounding which I salvaged from *his* father's archives.

After my initial corruption, I read many books and magazines, and though I found much that I liked, it grew ever clearer that Astounding/Analog had a very special place among them. The fine print in anthologies told me it was the birthplace of a disproportionate share of my favorite stories. The magazine itself was my most dependable monthly source of both entertainment and intellectual stimulation, not only through stories, but through articles, letters, and the unique editorials of John W. Campbell, Jr.

What was so special about Astounding? It's not as easy to say as some suppose. How can a few words accurately summarize the entire char-

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acter of an individual or a publication or anything else? They can't. But we who read it and enjoyed it know that Astounding/Analog has always had a distinctive character, and that, though it was not always the same in detail, it always had something to do with an emphasis on entertaining fiction, a zest for playing with new ideas, and a certain iconoclasm in regard to old ones.

Like many readers, I developed a couple of ambitions which, when I first conceived them, seemed about as remote and unattainable as any I could imagine. I wanted to meet and know John W. Campbell, the man who wrote those intriguing essays and otherwise shaped my favorite magazine during the years I knew it best; and I wanted to write a story that magazine would publish. I never seriously expected to achieve either. At that time I had no idea how easy the former was, because I had not yet discovered science fiction conventions. I knew how I could make efforts at the latter, though, and while I didn't really expect anything to come of them, postage was cheap (see, I'm not all *that* young) and I didn't know any better, so I tried. Only sporadically, at first, but later, while in graduate school, I made a determined assault. To my astonishment, John took an interest in what I was doing and wrote me long letters about my efforts—often gruff and rough on the ego, but I learned more about writing from the first half dozen of them than from all the courses I ever took put together. He had ulterior motives, of course, and in a rather short time he bought not one, but several of my stories. A little after that, I had a couple of lengthy visits with him, and found them quite as invigorating as I had expected.

Then he died, much too young and much to my shock. To my relief, though, his magazine found, in Ben Bova, an heir who could preserve and nurture the basic Analog character. Ben also continued the tradition of helping new writers. He continued my education while discovering several others, and it was his encouragement that led me to attempt my first novel.

Now I find myself editing Analog. (That was among my youthful dreams, too, but that one seemed too far-fetched to admit out loud.)

And Analog is fifty years old.

What about the next fifty years?

I don't expect to be actively involved in all of them, but I know the kind of direction I'm aiming for now. I spoke earlier of a "basic Analog character" and of "preserving and nurturing" that. That, in very general terms, is what I want to do.

But that does *not* mean several things that people sometimes assume it does.

It does not mean, for example, that I want to endlessly buy only one kind of story, or stories, which are imitations of others published here in the past. Nor has it ever been true that Analog published *only* what is sometimes called—misleadingly, in many cases—"hard" science fiction.

However....

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Consider yourself as an analog of Analog. Regardless of who you are, you have not always been the same person. In your extreme youth, you tried all kinds of things, many of which you chose not to pursue, while others initiated lines of development which have persisted throughout your subsequent life. Your appearance, your interests, your attitudes, your habits have gone through many changes. But through it all there have been certain subtle elements which have remained recognizably characteristic, those threads of continuity which make you recognizable as *you* even after years of growth and change.

So has it been with Analog. Those "threads of continuity" are the "basic character" I want to preserve and nurture, and recognition of them in no way precludes quite extensive evolution. "Nuture" means, among other things, to foster growth. If you're lucky, you'll continue to evolve along your basic track, improving your abilities and accomplishments, trying new things and evading such pitfalls as senility, for a long time.

That's what I want Analog to do.

I've already hinted at what I see as our basics: solidly entertaining stories with thought-provoking idea content. We shall continue to try to offer those at all times. We shall continue to provide a forum, in both fiction and nonfiction, for provocative ideas. Some of these involve things which can be done rather soon with materials and knowledge we now have. For example, articles and letters crossing my desk recently seem to show two suddenly blossoming trends in thinking about space. One is a consideration of unconventional hardware (such as the orbiting spaceport discussed in our last two issues) which might be used to greatly reduce the long-range cost of space. The other is a surge of interest in private rather than governmental financing of space ventures.

Analog has long been associated with another kind of provocative idea: the hypothesis, observation, or experiment which appears to cast doubt on ideas so generally accepted that they are tacitly assumed to be beyond question. In Analog, I think, we should assume that *nothing* is beyond question. These pages have seen extensive discussion of such things as Dean devices, parapsychology, possible limitations of relativity, dianetics, and dowsing. Whether or not any of these notions ultimately prove valid (and the questions are not all closed yet) is not the main issue. The important thing is that they, and others like them, represent areas which *may* have something to offer and which, for whatever reason, are not likely to get much attention in the orthodox journals of professional science. Orthodox views have been wrong in the past often enough to suggest that it is important to provide a place where possible objections and exceptions may be aired and thrashed out. If even a tiny percentage of the "fringe" ideas lead to significant breakthroughs, the

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space and effort devoted to their discussions will have been well spent. If the orthodox views hold up under the added questioning, we can be that much more confident of their validity. As Poul Anderson eloquently pointed out in a guest editorial here shortly after Campbell's death, there is a definite value in the very act of questioning. Questioning, be it noted, does not mean assuming that any old idea must be wrong. It means simply *asking the question*, consciously, and thinking anew about the answer. With that understanding, I hope that these pages may continue to be used for questioning *everything*—and most especially those things that we've fallen into the habit of thinking of as unquestionable.

Last month I promised to say something here about what I'm looking for in stories—and what sorts of things I see too often and too seldom among the manuscripts submitted. The question is a little tricky to answer, because these things often run in waves, and people sometimes overreact to what I say. Shortly after I arrived, I remarked that I was especially interested in good *short* stories—which tend to be scarce, because it's harder to make a story memorable in a few pages than in many. For a while after that I was so deluged with short stories that I had trouble getting enough novelettes. For a while I thought I would like to see more stories with contemporary or near-future settings; lately I've been seeing so many of those that I feel a lack of well-developed future and alien worlds. I also tend to get numerous stories on very similar themes within a short time, sometimes for no obvious reason.

But I don't want to suggest specific themes, anyway; ideally, I'd like to see some that neither I nor most of you have ever thought of before. I think the most significant thing I have observed over the whole time I've been here is a relative scarcity, in fiction manuscripts, of *any* of the kind of imaginative idea content I've been talking about. It used to be common to refer to science fiction as a "literature of ideas." Recently it's become fashionable in some circles to disparage that concept, and to speak of science fiction having shifted its emphasis to good writing and

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character development. "Shifted," I think, is a dangerous choice of words. I'm very much in favor of good writing and characterization—but not at the *expense* of the vigorous exploration of original, challenging ideas. If writing quality and characterization are your only important concerns, you don't need science fiction at all—ideas are the something extra that science fiction gives. And I refuse to believe there are no more worth exploring. Some writers still find them; and I see far too many possibilities for what might be found or built or learned in deep space and distant worlds and far futures, too many contemporary discoveries with startling implications if extrapolated far enough, and too many social problems that invite the conception of whole new systems to solve them. New discoveries continually suggest new possibilities—and I can't foresee that ever ending.

It's true that few ideas are strong enough to carry a story by themselves. But there have been some, and there will be more. I hope to see more of them. Even the strongest idea will not make a memorable story without at least competent storytelling, of course. But if I have to choose, I would often prefer an adequately but not spectacularly written story with a blockbuster idea behind it to a piece of beautiful writing with nothing to say. I see the latter these days, more often than the former.

What I'd rather have than either, of course, is the blockbuster idea *and* magnificent writing. But the preceding paragraph should give you some idea of where I think emphasis needs to be reapplied. It's a time to remember that good writing, good characterization, and good ideas are not mutually exclusive—and two out of three are not always good enough. What I'm seeking most of all are stories that have all three, welded into a foundation and superstructure so solid and well-matched that the seams don't show and the whole thing will stand up under years of close scrutiny.

If I can find them often enough, the future of Analog should be as bright as its past—and, I venture to hope, even brighter. ■

The dilemma of today is not that the human values cannot control a ***mechanical science.***
It is the other way about: the scientific spirit is more human than the machinery of governments.
We have not let either the tolerance or the empiricism of science enter the parochial rules by which we still try to prescribe the behaviour of nations.

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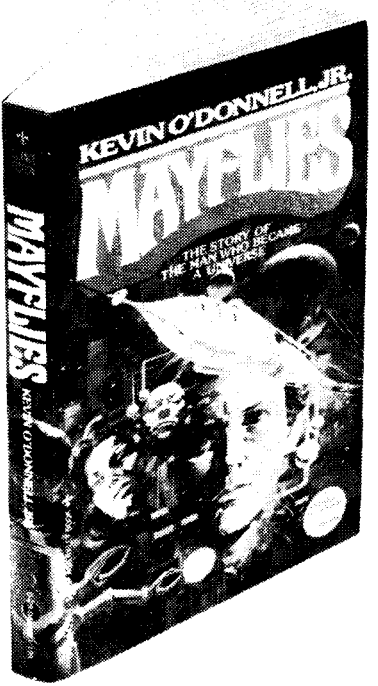

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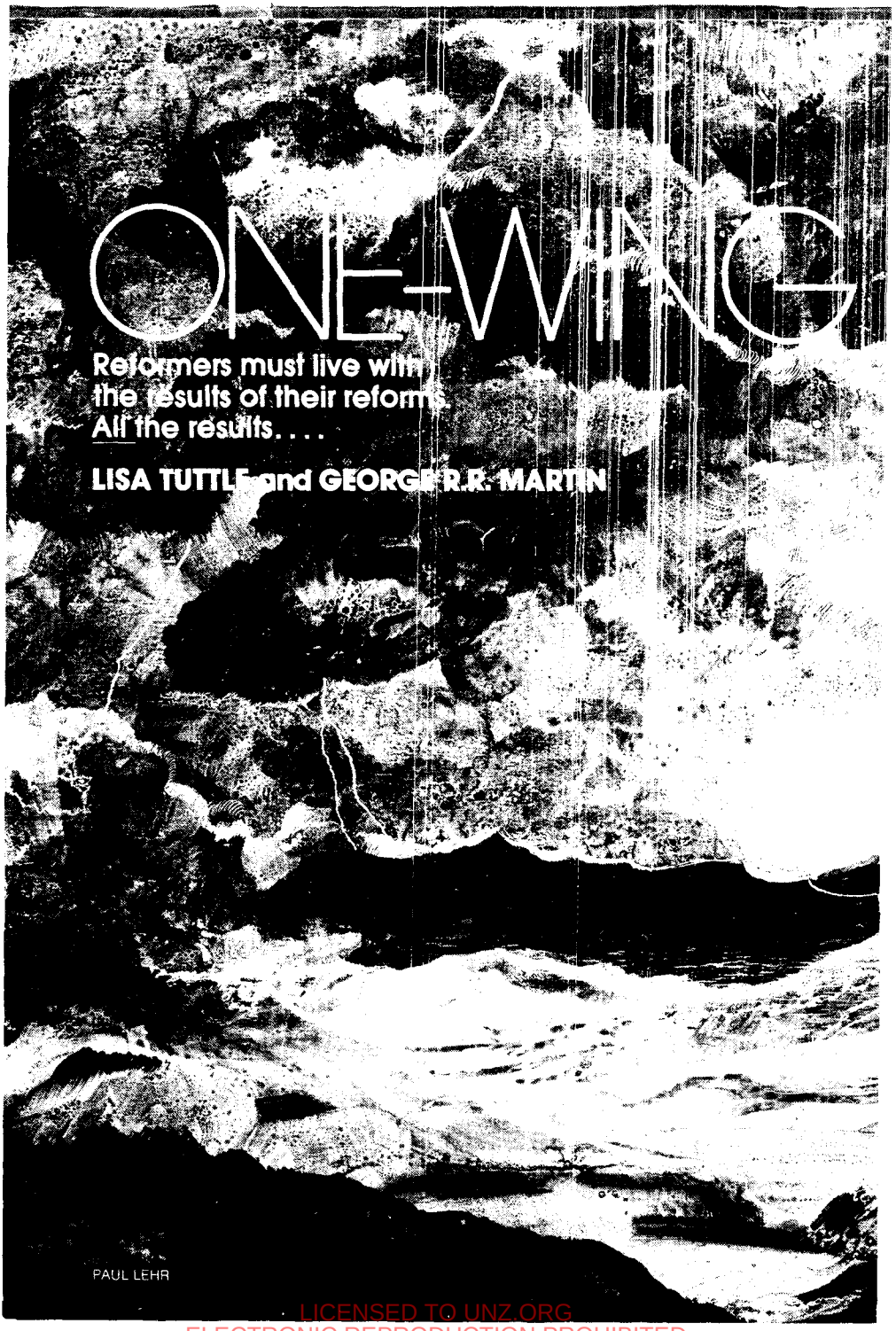
ONE-WING
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LISA TUTTLE and GEORGE R.R. MARTIN
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The oddest thing about dying was how easy it was, how calm and beautiful.

The still air had come upon Maris without warning. An instant before, the storm had raged all around her. Rain stung her eyes and ran down her cheeks and tinged against the silver metal of her wings, and the winds were full of tumult, pushing her this way and that, slapping her contemptuously from side to side as if she were a child new to the air. Strapped beneath the wing struts, her arms ached from the struggle. Dark clouds obscured the horizon while the sea below was frothing and troubled; land was nowhere in sight. Maris cursed and hurt and flew.

Then peace enveloped her, and calm, and death.

The winds quieted and the rains stopped. The sea ceased its wild heaving. The clouds themselves seemed to draw back, until they were infinitely far away. A silence fell, an eerie hush, as if time had paused to catch its breath.

In the still air, with her bright wings spread wide, Maris began to descend.

It was a slow, gradual descent, a thing of beauty, graceful and inevitable. Without a breeze to push or lift, she could only glide forward and down. It was not a fall. It seemed to last forever. Far ahead she could see the spot where she would hit the water.

Briefly her flyer's instincts bid her struggle. She banked this way and that, tried to tack, searched vainly for an updraft or a current in the quiet sky. Her wings, twenty feet across, lifted and fell, and a sudden shaft of wan sunlight gleamed on the silver metal. But her descent continued.

Then she was calm, as calm as the air, her inner turmoil as still as the sea below. She felt the deep peace of surrender, the relief of ending her long battle with the winds. She had always been at their mercy, she thought, never truly in control. They were wild and she was weak, and she was foolish to have dreamed otherwise. She looked up, wondering if she would see the ghost flyers who were said to haunt still air.

The tips of her boots brushed the water and then her body shattered the grey, smooth mirror of the ocean. The impact of the cold water seared her like a flame, and she sank...

...and woke, wet and gasping for breath.

Silence pounded in her ears. The sweat on her body dried in the cool air, and she sat up, disoriented and blind. Across the room she could see a thin red line of banked coals, but they were at the wrong side of the bed to be the Eyrie, and too far away for her fireplace at home. The air smelled faintly of damp and sea mold.

The smell gave it away. She was at the academy, she thought with relief, at Woodwings; suddenly all the shadows and the strangenesses resolved themselves into the mundane and the familiar. Tension drained slowly from her body, and now Maris was fully awake. Pulling a roughly-woven shift over her head, she moved carefully

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across the dark room to the fireplace, where she took a woven taper from the pile and lit a sand candle.

In the light she saw the little stone jug beside her low bed, and smiled. Just the thing to wash away the nightmares.

She sat cross-legged on the bed as she sipped the cool, woody wine, staring at the flickering candle flame all the while. The dream disturbed her. Like all the flyers of Windhaven, Maris feared still air, but until now she did not have nightmares about it. And the peace of it all, the sense of surrender and acceptance; those were the worst parts. I am a flyer, she thought, and that was not a true flyer's dream.

Someone knocked on her door.

"Enter," Maris said, setting the wine jug aside.

S'Rella stood in the doorway, a slight, dark girl with her hair cropped short in the Southern fashion. "Breakfast soon, Maris," she said, the slight slurring of her speech reflecting her origins.

"Sena wants to see you before, though. Up in her room."

"Thanks," Maris said, smiling. She liked S'Rella, perhaps best of all the students at the Woodwings academy. The island in the Southern Archipelago where S'Rella had been born was a world away from Maris' own Lesser Amberly, but despite their differences Maris saw a lot of herself in the younger girl. S'Rella was small but determined, with a stamina that belied her size. At the moment she was still graceless in the sky, but she was stubborn enough to give hope of quick improvement. Maris had been working with Sena's flock of would-be flyers for nearly ten full days now, and she had come to regard S'Rella as one of the three or four most promising.

"Shall I wait and show you the way?" she asked when Maris climbed off the bed to wash at the basin of water in the far corner of the room.

"No," Maris said. "Off to breakfast now. I can find Sena well enough by myself." She smiled to soften the dismissal, and S'Rella smiled back, a little shyly, before she left.

A few minutes later Maris was having second thoughts as she groped along a narrow, dank corridor in search of Sena's cubbyhole. Woodwings academy was an ancient structure, a huge rock shot through with tunnels and caves, some natural, others hollowed out by human hands. Its lower chambers were perpetually flooded, and even in the upper, inhabited portions, many of the rooms and all of the halls were windowless, cut off from sun and stars. The sea smell was everywhere. In the old days it had been a fortress, built in some time of trouble and then unoccupied until the Landsman of Seatooth had offered it to the flyers as a site for a training academy. In the seven years since, Sena and her charges had restored much of it, but it was still easy to take a wrong turn and get lost in the abandoned sections.

Time passed without a trace in the corridors of Woodwings. Torches burned down in wall-sockets and oil

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lamps ran short of oil, and days often passed before anyone noticed. Maris felt her way carefully along one such stretch of corridor, nervous and a bit oppressed by the weight of the old fortress upon her. She did not like being underground and enclosed; it quarreled with all her flyer's instincts.

With relief Maris saw the dim glow of a light ahead. One last, sharp corner and she found herself back in familiar territory. Unless she had gotten turned around completely, Sena's room was the first to the left.

"Maris." Sena looked up and smiled. She was sitting in a wicker chair, carving a soft block of wood with a bone knife, but now she set it aside and motioned Maris to enter. "I was about to call for S'Rella again and send her looking for you. Did you get lost in our maze?"

"Almost," Maris said, shaking her head. "I should have thought to carry a light. I can get from my room to the kitchen or the common room or the outside, but beyond that it is a less certain proposition."

Sena laughed, but it was only polite laughter, masking a mood that was far from light. The teacher was a former flyer, three times Maris' age, made land-bound a decade ago in the sort of accident all too common among flyers. Normally her vigor and enthusiasm cloaked her age, but this morning she looked old and tired. Her bad eye, like a piece of milky seaglass, seemed to weigh down the left side of her face. It sagged and trembled beneath its burden.

"You sent S'Rella to me for a reason," Maris said. "News?"

"News," Sena said, "and not good. I thought it best not to talk about it at breakfast until I had discussed it with you."

"Yes?"

"Eastern has closed Airhome," Sena said.

Maris sighed and leaned back in her chair. Suddenly she too felt weary. The news was no great surprise, but it was still disheartening. "Why now?" she asked. "I spoke to Nord three months ago, when they sent me out with a message to Far Hunderlin. He thought they would keep the doors open at least through the next competition. He even told me that he had several promising students."

"There was a death," Sena said. "One of those promising students made a misjudgment, and struck a cliffside with her wing. Nord could only watch helplessly as she fell to the rocks below. Worse, her parents were there too. Wealthy, powerful people —traders from Cheslin with more than a dozen ships. The girl had been showing off for them. The parents went directly to the Landsman, of course, asking for justice. They said Nord was negligent."

"Was he?" Maris said.

Sena shrugged. "He was a mediocre flyer even when he had his wings, and I cannot believe he was better than that as teacher. Always too eager to impress. And he constantly overpraised and overestimated his students. Last year, in the competi-

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tion, he sponsored nine in challenges. They all failed, and most had no business trying. I sponsored only three. This girl that died, I'm told, had been at Airhome only a year. A *year*, Maris! She had talent perhaps, but Nord let her go too far too soon. Well, it is too late now. You know the academies have been a drain, a useless drain to hear some Landsmen talk. All they needed was an excuse. They dismissed Nord and closed the school. End. And all the children of Eastern can give up their dreams now, and content themselves with their lot in life." Her voice was bitter.

"Then we are the last," Maris said glumly.

"We are the last," Sena echoed. "And for how long? The Landsman sent a runner to me last night, and I hobbled up to get this joyous news, and afterwards we talked. She is not happy with us, Maris. She says that she has given us meat and hearth and iron coin for seven years, but we have given her no flyer in return. She is growing impatient."

"So I gather," Maris said. She knew the Landsman of Seatooth only by reputation, but that was enough. Seatooth lay close by Big Shotan but had a long, fierce history of independence. Its present ruler was a proud, ambitious woman who was deeply resentful that her island had never had a flyer of its own. She had campaigned hard to make Seatooth the home of the training academy for the Western Archipelago, and once she had been lavish in her support. But now she expected results. "She doesn't understand," Maris said. "None of the land-bound understand, *really*. The woodwingers come to the competitions almost raw, to vie with seasoned flyers and flyer-children who have been bred and reared to wings. If only they would give you *time*..."

"Time, time, time," said Sena, a hint of anger in her voice. "Yes, I said as much to the Landsman. She said that seven years was enough time. You, Maris, you are a flyer. I was a flyer once. We know the difficulties, the need for training year after year, for practice until your arms tremble with the effort and your palms come away bloody from the wing grips. The land-bound know none of that. Too many of them thought the fight was over seven years ago, when you and your friends convinced the flyers to let those of land-bound parentage compete for wings. They thought that next week the sky would be full of fisherfolk and cobblers and glassblowers, and they were dismayed when the first competition came and went and the flyers and flyer-children defeated all land-bound challengers.

"At least *then* they cared. Now they are only resigned, I fear. In the seven years since your great council, the seven years of the academies, only once has a land-bound taken wings. And *he* lost them back again a year later, at the very next competition. These days I think the island folk come to the meets only to see flyer siblings compete for the family wings.

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The challenges from my woodwingers are talked about as a kind of a comic interlude, a brief performance by some jesters to lighten up the moments between the serious races."

"Sena, Sena," Maris said with concern. The older woman had poured all of the passion of her own broken life into the dreams of the young people who came to Woodwings asking for the sky. Now she was clearly upset, her voice trembling despite herself. "I understand your distress," Maris said, taking Sena's hand within her own, "but it isn't as bad as you say."

Sena's good eye regarded Maris skeptically, and she pulled her hand away. "It is," she insisted. "Of course they don't tell *you.* No one wants to bring bad news, and they all know what the academies mean to you. But it's true." Maris tried to interrupt, but Sena waved her quiet. "No, enough, and not another word about my distress. I did not call you here to comfort me, or to make us late for breakfast. I wanted to tell you the news privately, before I told the others. And I wanted to ask you to fly to Big Shotan for me."

"Today?"

"Yes," Sena said. "You have been doing good work with the children. It is a real benefit to them to have an actual flyer in their midst. But we can spare you for one day. It should only take a few hours."

"Certainly," Maris said. "What is this about?"

"The flyer who brought the news about Airhome to the Landsman also brought another message. A private message for me. One of Nord's students wishes to continue his studies here, and hopes that I will sponsor him in the next competition. He asks permission to travel here."

"Here?" Maris said, incredulous. "From Eastern? Without wings?"

"He has word of a trader bold enough to try the open seas, I am told," Sena said. "The voyage is hazardous, to be sure, but if he is willing to make it I will not begrudge him admission. Take my agreement to the Landsman of Big Shotan, if you would. He sends three flyers to Eastern every month, and one is due to leave on the morrow. Speed is important. The ships will take a month getting here even if the winds are kind, and the competition is only two months away."

"I could take the message direct to Eastern myself," Maris suggested.

"No," said Sena. "We need you here. Simply relay my word to Big Shotan and then return to fly guard on my clumsy young birds." She rose unsteadily from her wicker chair, and Maris stood up quickly to help her. "And now we should see about breakfast," Sena continued. "You need to eat before your flight. With all the time we have spent talking, I fear the others have probably eaten our share."

But breakfast was still waiting when they reached the common room. Two blazing hearths kept the large hall warm and bright in the damp morning. Gently curving walls of stone rose

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to become an arched and blackened ceiling. The furniture was rough and sparse: three long wooden tables with benches running the length on each side. The benches were crowded with students now, talking and joking and laughing, most at least half finished with their meals. Nearly twenty would-be flyers were currently in residence, ranging in age from a woman only two years younger than Maris to a boy just shy of ten.

The hall quieted only a little when Maris and Sena entered, and Sena had to shout to be heard above the din and clatter. But after she had finished speaking, it was very quiet indeed.

Maris accepted a chunk of black bread and a bowl of porridge and honey from Keri, a chubby youth who was taking his turn as cook today, and found a place on one of the benches. As she ate, she conversed politely with the students on either side of her, but she could sense that neither had their heart in it, and after a short time both of them excused themselves and left. Maris could not blame them. She remembered how she had felt, years earlier, when her own dream of being a flyer had been imperiled, as their dreams were imperiled now. Airhome was not the first academy to shut its doors. The desolate island-continent of Arielha had given up first, after three years of failure, and the academies in the Southern Archipelago and the Outer Islands had followed it into oblivion. Eastern's Airhome was the fourth closing, leaving only Woodwings. No wonder the students were sullen.

Maris mopped her plate with the last of the bread, swallowed it, and pushed back from the table. "Sena, I will not be back until tomorrow morning," she said as she rose. "I'm going to fly to the Eyrie after Big Shotan."

Sena looked up from her own plate and nodded. "Very well. I plan to let Leya and Kurt try the air today. The rest will exercise. Be back as early as you can." She returned to her food.

Maris sensed someone behind her, and turned to see S'Rella. "May I help you with your wings, Maris?"

"Of course you may. Thank you."

The girl smiled. They walked together down the short corridor to the little room where the wings were kept. Three pair of wings hung on the wall now; Maris' own and two owned by the academy, dying bequests from flyers who had left no heir. It was hardly surprising that the woodwingers fared so poorly in competition, Maris thought bitterly as she contemplated the wings. A flyer sends his child into the sky almost daily during the years of training, but at the academies—with so many students and so few wings—practice time was not so easily come by. There was only so much you could learn on the ground after all.

She pushed the thought away and lifted her wings from the rack. They made a compact package, the struts folded neatly back on themselves, the tissue-metal hanging limply between and drooping towards the floor like a silver cape. The tissue itself, the stuff

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of the vast sail that had pushed their ancestors to Windhaven, was virtually weightless, so the wings were deceptively light. S'Rella held them up easily with one hand while Maris partially unfolded them, checking each strut and joint carefully with fingers and eyes for any wear or defect which might become evident, too late, as a danger in the air.

"It's bad about them closing Airhome," S'Rella said as Maris worked. "It happened just the same way in Southern, you know., That was why I had to come here, to Woodwings. Our own school was closed."

Maris paused and looked at her. She had almost forgotten that the shy Southern girl had been a victim of a previous closing. It must be especially hard on her. "One student from Airhome is coming here, as you did," Maris said, trying to make a jest of it. "So you won't be alone among the savage Westerners anymore." She smiled.

"Do you miss your home?" S'Rella asked suddenly.

Maris thought for a moment. "Truthfully, I don't know that I really have a home," she said. "Wherever I am is my home."

S'Rella digested that calmly. "I suppose that's a good way to feel, if you're a flyer. Do most flyers feel that way?"

"Maybe a little bit," Maris said. She glanced back to her wings and set her hands to work again. "But not so much as me. Most flyers have more ties to their home islands than I do, though never so many as the landbound. Could you help me stretch that taut? Thanks. No, I didn't mean that particularly because I'm a flyer, but just because my old home is gone and I haven't made a new one yet. My father—my stepfather, really—died three years ago. His wife died long before that, and my own natural parents are both dead as well. I have a step-brother, Coll, but he's been off adventuring and singing in the Outer Islands for a long time now. The little house on Lesser Amberly seemed awfully big and empty with Coll and Russ both gone. And since I had no one to go home to, I went there less and less. The island survives. The Landsman would like his third flyer to be in residence more often, no doubt, but he makes do with the two at hand." She shrugged. "My friends are flyers, mostly."

"I see."

Maris looked at S'Rella, who was staring at the wing she still held with more concentration than it warranted. "You miss your home," Maris said gently.

S'Rella nodded slowly, almost reluctantly. "It's different here. The others are different from the people I knew."

"A flyer has to get used to that," Maris said.

"Yes. But there was someone I loved. We talked of marrying, but I knew we never would. I loved him—I still love him—but I wanted to be a flyer even more. You know."

"I know," Maris said, trying to be encouraging. "Perhaps, after you win

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your wings, he could—"

"No. He'll never leave his land. He can't. He's a farmer, and his land has always been in his family. He—well, he never asked me to give up the idea of flying, and I never asked him to give up his land."

"Flyers have married farmers before," Maris said. "You could go back."

"Not without wings," S'Rella said fiercely. Her eyes met Maris'. "No matter how long it takes. And if—when—I win my wings, well, he'll have married by then. He's bound to. Farming isn't a job for a single person. He'll want a wife who loves the land, and a lot of children."

Maris said nothing.

"Well, I made my choice." S'Rella said. "It's just that sometimes I get... homesick. Lonely, maybe."

"Yes," Maris said. She put a hand on S'Rella's shoulder. "Come, I have a message to deliver."

S'Rella led the way. Maris slung her wings over a shoulder and followed down a dark passageway that led to a well-fortified exit. It opened on what once had been an observation platform, a wide stone ledge eighty feet above where the sea crested and broke against the rocks of Seatooth. The sky was grey and overcast, but the wild salt smell of the ocean and the strong, eager hands of the wind filled Maris with exhilaration.

S'Rella held the wings while Maris fastened the restraining straps around her body. When they were secure, S'Rella began to unfold them, strut by strut, locking each into place so the silver tissue pulled tight and strong. Maris waited patiently, aware of her role as teacher, although she was anxious to be off. Only when the wings were fully extended did she smile at S'Rella, slide her arms through their loops, and wrap her hands around the worn, familiar leather of the wing grips. Then, with four quick steps, she was off.

For a second, or less than a second, she fell, but then the winds took her, thrumming against her wings, lifting her, turning her plunge into flight, and the feel of it was like a shock running through her, a shock that left her flushed and breathless and set her skin to tingling. That instant, that little space of less than a second, made it all worthwhile. It was better and more thrilling than any sensation Maris had ever known, better than love, better than everything. Alive and aloft, she joined the strong western wind in a lover's embrace.

Big Shotan lay to the north, but for the moment Maris let the prevailing wind carry her, luxuriating in the fine freedom of an effortless soar before beginning her game with the winds, when she would have to tack and turn, test and tease them into taking her where she chose to go. A flight of rainbirds darted past her, each a different bright color, their haste an omen of a coming storm. Maris followed them, climbing higher and higher, rising until Seatooth was only a green and grey area off to her left, smaller than her hand. She could see Eggland as well,

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and off in the distance the fog banks that shrouded the southernmost coast of Big Shotan.

Maris began to circle, deliberately slowing her progress, aware of how easy it would be to overshoot her destination. Conflicting air currents whispered past her ears, taunting her with promises of a north-bound gale somewhere above, and she rose again, seeking it in the colder air far above the sea. Now Big Shotan's coast and Seatooth and Eggland were all spread out before her on the metallic grey ocean like toys on a table. She saw the tiny shapes of fishing boats bobbing in the harbors and bays of Shotan and Seatooth, and the gulls and scavenger-kites in the hundreds wheeling around the sharp crags of Eggland.

She had lied to S'Rella, Maris realized suddenly. She *did* have a home, and it was here, in the sky, with the wind strong and cold behind her and her wings on her back. The world below, with its worries about trade and politics and food and war and money, was alien to her, and even at the best of times she always felt a bit apart from it. She was a flyer, and like all flyers, she was less than whole when she took off her wings.

Smiling a small, secret smile, Maris went to deliver her message.

The Landsman of Big Shotan was a busy man, kept occupied by the endless task of ruling the oldest, richest, and most densely populated island on Windhaven. He was in conference when Maris arrived—some sort of fishing dispute with Little Shotan and Skulny—but he came out to see her. Flyers were the equals of the Landsman, and it was dangerous for even one so powerful as he to slight them. He heard Sena's message dispassionately, and promised that word would travel back to Eastern the next morning, on the wings of one of his flyers.

Maris left her wings on the wall of the conference room in the Old Captain's House, as the Landsman's ancient sprawling residence was named, and spent the rest of the afternoon wandering the streets of the city beyond. It was the only real city on Windhaven; oldest, largest, and first. Stormtown, it was called; the town the star sailors built. Maris found it endlessly fascinating. There were windmills everywhere, their great blades churning against the grey sky. There were more people here than on Lesser and Greater Amberly together. There were shops and stalls of a hundred different sorts, selling every useful good and worthless trinket imaginable. There were endless numbers of wineshops and inns and alehouses, and there was a market that was a wonder to her every time she came upon it. She spent several hours there, browsing happily and listening to the talk, although she bought very little. Afterwards she ate a light dinner of smoked moonfish and black bread, washed down with a mug of *kivas,* the hot spice wine that Shotan prided itself on. The inn where she took her meal had a singer and Maris listened

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to him politely enough, though she thought him much inferior to her brother Coll and other singers she had known on Amberly.

It was close to dusk when she flew from Stormtown, in the wake of a brief squall that had washed the city streets with rain while she ate. She had good winds at her back all the way, and it had just turned dark when she reached the Eyrie.

It hulked out of the sea at her, black in the bright starlight, a weathered column of ancient stone whose sheer walls rose two hundred feet straight up from the foaming waters; nothing grew on the Eyrie, and no safe landing was on hand for any boat, but atop it stood the flyers' lodge, their meeting place and refuge forever inaccessible to those without wings. Maris saw lights within the windows. She circled once and came down skillfully in the landing pit, full of damp sand. Alone, it took her several minutes to remove and fold her wings. She hung them on a hook just inside the door.

A small fire was blazing in the hearth of the common room. In front of it, two flyers she knew only by sight were engrossed in a game of geechi, shoving black and white pebbles around a board. One of them waved at her. She nodded in reply, but by then his glance had already gone back to his game.

There was one other present, slumped in an armchair near the fire with an earthenware mug in his hand, studying the flames. But he looked up when she entered "Maris!" he said, rising suddenly and grinning. He set his mug aside and started across the room. "I hadn't expected to see you here."

"Dorrel," she said, but then he was there, and he put his arms around her and they kissed, briefly but with intensity. One of the geechi players watched them in a distracted sort of way, but his gaze fell quickly when his opponent moved a stone.

"Did you fly all the way from Amberly?" Dorrel asked her. "You must be hungry. Sit by the fire and I'll fetch you a snack. There's cheese and smoked ham and some sort of fruitbread in the kitchen."

Maris took his hand and squeezed it and led him back towards the fire, choosing two chairs well away from the geechi players. "I ate not too long ago," she said, "but thanks. And I flew from Big Shotan, not Amberly. An easy flight. The winds are friendly tonight. I haven't been to Amberly in almost a month, I'm afraid. The Landsman is going to be angry."

Dorrel did not look too happy himself. His lean face wrinkled in a frown. "Flying? Or gone to Seatooth again?" He released her hand and found his mug again, sipping from it carefully. Steam rose from within.

"Seatooth. Sena asked me to come spend some time with the students. I've been working with them for about ten days. Before that I was on a long mission, to Deeth in the Southern Archipelago."

Dorrel set down his mug and sighed. "You don't want to hear my opinion," he said cheerfully, "but I'm going to tell it to you anyway. You

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spend too much time away from Amberly, working at the academy. Sena is teacher there, not you. She is paid good metal for doing what she does. I don't see her pressing any iron into your palm."

"I have enough iron," Maris said. "Russ left me well off. Sena's lot is harder. And the woodwingers need my help—they see precious few other flyers on Seatooth." Her voice became warmer, coaxing. "Why don't you come spend a few days yourself? Laus would survive a week without you. We could share a room. I'd like to have you with me."

"No." His cheerful tone vanished abruptly, and he looked vaguely irritated. "I'd love to spend a week with you, Maris, in my cabin on Laus, or your home on Amberly, or even here in the Eyrie. But not at Woodwings. I've told you before: I won't train a group of land-bounds to take the wings of my friends."

His words wounded her. She pulled back her chair and looked away from him, into the fire. "You sound like Corm, seven years ago," she said.

"I don't deserve that, Maris."

She turned back to look at him. "Then why won't you help? Why are you so contemptuous of the woodwingers? You sneer at them like the most tradition-bound old flyer—but seven years ago you were with me. You fought for this, believed in it with me. I could never have done it without you—they would have taken my wings and named me outlaw. You risked the same fate by helping me. What has changed you so?"

Dorrel shook his head violently. "I haven't changed, Maris. Listen. Seven years ago, I fought for *you*. I didn't care about those precious academies you dreamed up—I fought for your right to keep your wings and be a flyer. Because I loved you, Maris, and I would have done anything for you. And," he went on, his tone a little cooler, "you were the best damn flyer I'd ever seen. It was a crime, madness, to give your wings to your brother and ground you. Now, don't look at me like that. Of course the principle mattered to me, too."

"Did it?" Maris asked. It was an old argument, but it still upset her.

"Of course it did. I wouldn't fly in the face of all I believed just to please you. The system as it existed was unfair, forcing good flyers to be land-bound before their time, and sending up unskilled children who had no right to the wings beyond an accident of birth. The traditions had to be changed—you were right about that. If a child born of a sailmaker and a farmer can outfly one born of a flyer, he deserves wings. I believed that then, and I believe it now."

"You believe it," Maris said bitterly. "You say that, but words are easy. You won't do anything for your belief—you won't help me now, although we're on the verge of losing all we fought for."

"We aren't going to lose it. We won. We changed the rules—we changed the world."

"But without the academies, what

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does it mean?"

"The academies! I didn't fight for the academies. Changing bad tradition was what I fought for. I'll agree that if a land-bound can outfly me, I must give him my wings. But I will not agree to teach him to outfly me. And that's what you're asking of me. You, of all people, should understand what it means to a flyer to lose the sky."

"I also understand what it is to want to fly but to know that there's no chance of ever being allowed to," Maris said. "There's a student at the academy—S'Rella. You should have heard her this morning, Dorrel. She wants to fly more than anything. She's a lot like I was, when Russ first began to teach me how to fly. Please come help her, Dorr."

"If she really is like you, she'll be flying soon enough, whether I choose to help her or not. So I choose not. Then if she defeats a friend of mine, takes his wings in competition, I won't feel guilty." He drained his mug and stood up.

Maris scowled and was seeking another argument when he said, "Have some tea with me?" She nodded, watching him go to the kettle on the fire where the fragrant spiced tea steamed. His stance, his walk, the way he bent to pour the tea—all so familiar to her. She knew him probably better than she had ever known anyone, she thought.

When Dorrel returned with the hot, sweetened drinks and took his place close to her again, the anger was gone, her thoughts having taken another direction. Her gaze was intense.

"What happened to us, Dorr? A few years ago we planned to marry. Now we glare at each other from our separate islands and squabble like two Landsmen arguing fishing rights. What happened to our plans to live together and have children—what happened to our love?" She smiled ruefully. "I don't understand what happened."

"Yes you do," Dorrel said, his voice gentle. "This argument happened. Your loves and your loyalties are divided between the flyers and the land-bound. Mine aren't. Life isn't simple anymore—not for you. We don't want the same things, and it's hard for us to understand each other. We loved each other so much once...." He sipped the hot tea, his eyes cast down. Maris watched him, waiting, feeling sad. She wished for a moment that they could return to that earlier time, when their love had been so singleminded and strong that it had seemed certain to weather all storms.

Dorrel looked up at her again. "But I still love you, Maris. Things have changed, but the love's still there. Maybe we can't join our lives, but when we *are* together we can still love each other and try not to fight, hmm?"

She smiled at him, a bit tremulously, and put her hand out. He grasped it strongly and smiled.

"Now. No more arguing, and no more sad talk of what might have been. We have the present—let's enjoy it. Do you realize it's been nearly

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two months since we were together last? Where have you been? What have you seen? Tell me some news, love. Some good gossip to cheer me up," he said.

"My news isn't very cheerful," Maris said, thinking about the messages she'd heard and carried recently. "Eastern has closed Airhome. One of the students there has died in an accident. Another one is taking ship to Seatooth. The others have given up and gone home, I suppose. Don't know what Nord will do." She disengaged her hand and reached for her tea.

Dorrel shook his head, a small smile on his face. "Even your news is of nothing but the academies. Mine's more interesting. The Landsman of Scylla's Point died, and his youngest daughter was chosen to succeed him. Rumor has it that Kreel—d'you know him? Fair-haired boy missing a finger on his left hand? You might have noticed him at the last competition, he did quite a lot of fancy double-loops—anyway, that he's going to become Scylla Point's second flyer because the new Landsman's in love with him! Can you imagine—a Landsman and a flyer married?"

Maris smiled slightly. "It's happened before."

"Not in our time. Did you hear about the fishing fleet off Greater Amberly? Destroyed by a scylla, though they managed to kill it, and most got away with their lives, even if without their boats. Another scylla, dead, washed up on the shores of Culhall—I saw the carcass." He raised his brows and held his nose. "Even against the wind I could smell it! And up in Artellia, word is that two flyer-princes are warring for control of the Iron Islands." Dorrel stopped speaking, his head turning toward the door as a violent gust of wind from outside rattled the heavy lodge door.

"Ah," he said, turning back and sipping his tea. "Just the wind."

"What is it?" Maris asked. "You're so restless. Are you expecting someone?"

"I thought Garth might come." He hesitated. "We were supposed to meet here this afternoon, but he hasn't shown up. Nothing important, but he was flying a message out to Culhall and said he'd meet me here on the way back and we'd get drunk together."

"So maybe he got drunk alone. You know Garth." She spoke lightly, but she saw that he was truly worried. "A lot of things could have delayed him—perhaps he had to fly an answer back. Or he might have decided to stay on Culhall for a party. I'm sure that he's all right."

Despite her words, Maris, too, was worried. Garth was an old and dear friend to them both. The last time she had seen him he had obviously put on weight—always dangerous for a flyer. And he was too fond of parties, particularly the wine and the food. She hoped he was safe and well. He'd never been a reckless flyer—that was comforting to remember—but he'd also never been more than solid and competent in the air. As he grew older,

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heavier and slower in his responses, the steady skills of his youth were becoming less certain.

"You're right," Dorrel said. "Garth can take care of himself. He probably met up with some good companions on Culhall and forgot about me. He likes to drink, but he'd never fly drunk." He drained his mug and forced a smile. "We might as well return the favor and forget about him. At least for tonight."

Their eyes met, and they moved to a low, cushioned bench closer to the fire. There they managed, at least for a time, to put aside their conflicts and fears as they drank more tea and later wine, and talked of good times from the past and exchanged gossip about the flyers they both knew. The evening passed in a pleasant haze, and much later that night they shared a bed and something more than memories. It was good to hold someone she cared about, Maris thought, and to be held in turn, after so many nights in her narrow bed alone. His head against her shoulder, his body a solid comfort against hers, Maris fell asleep at last, warm and contented.

But that night she dreamed again of falling.

The next day Maris rose early, cold and frightened from her dream. She left Dorrel sleeping and ate a lonely breakfast of hard cheese and bread in the deserted common room. As the sun brushed the horizon she donned her wings and gave herself to the morning wind. By midday she was back at Seatooth, flying guard for S'Rella and a boy named Jan while they tried their fledgling wings.

She stayed and worked with the woodwingers for another week, watching their unsteady progress in the air, helping them through their exercises, telling them stories of famous flyers each night around the fire.

But increasingly she felt guilty over her prolonged absence from Lesser Amberly, and finally she took her leave, promising Sena she would return in time to help prepare the students for their challenges.

It was a full day's flight to Amberly. She was exhausted when she finally saw the fire burning in its familiar light tower, and very glad to collapse into her own long-empty bed. But the sheets were cold and the room was dusty, and Maris found it hard to sleep. Her own familiar house seemed cramped and strange to her now. She rose and went in search of a snack, but she had been gone too long—the little food left in the kitchen was stale or spoiled. Hungry and unhappy, she returned to a cold bed and a fitful sleep.

The Landsman's greeting was polite but aloof when she went to him the next morning. "The times have been busy," he said simply. "I've sent for you several times, only to find you gone. Corm and Shalli have flown the missions instead. They grow weary. And now Shalli is with child. Are we to content ourselves with a single flyer, like a poor island half our size?"

"If you have flying for me to do, give it to me," Maris replied. She

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could not deny the justice of his complaint, yet neither would she promise to stay away from Seatooth.

The Landsman frowned, but there was nothing else he could do. He recited a message to her, a long involved message to the traders on Poweet, seed grain in return for canvas sails, but only if they would send the ships to get it, and an iron bribe for their support in some dispute between the Amberlys and Kesselar. Maris memorized it word for word without letting it fully touch her conscious mind, as flyers often did. And then she was off to flyer's cliff and the sky.

Anxious not to let her get away again, the Landsman kept her occupied. No sooner would she return from one mission than up she went again on another; back and forth to Poweet four times, twice to Little Shotan, twice to Greater Amberly, once to Kesselar to deliver a stern warning to a young Landsman who could scarce contain her anger, once each to Culhall and Stonebowl and Laus (Dorrel was not at home, off on some mission himself), once on a long flight to Kite's Landing in Eastern.

When at last she found herself free to escape to Seatooth again, barely three weeks remained before the competition commenced.

"How many do you intend to sponsor in challenges?" Maris asked. Somewhere outside rain and wind lashed the island, but the thick stone walls which enclosed them kept the weather very far away. Sena sat on a low stool, a torn shirt in her hands, and Maris stood before her, warming her back by the fire. They were in Sena's room.

"I had hoped to ask your advice on that," Sena said, looking up from her clumsy job of mending. "I think four this year, perhaps five."

"S'Rella certainly," Maris said, thoughtfully. Her opinions might influence Sena, and Sena's sponsorship was all-important to the would-be flyers. Only those who won her approval were allowed to issue challenge. "Damen as well. They are your best. After them—Sher and Leya, perhaps? Or Liane?"

"Sher and Leya," Sena said, stitching. "They would be impossible if I sponsored one and not the other. It will be chore enough to convince them that they cannot challenge the same person and race him as a team."

Maris laughed. Sher and Leya were two of the younger aspirants, inseparable friends. They were talented and enthusiastic, although they tired too easily and could be rattled by the unexpected. She had often wondered if their constant companionship gave them strength, or simply reinforced their similar faults. "Do you think they can win?"

"No," Sena said, without looking up. "But they are old enough to try, and lose. The experience will do them good. Temper them. If their dreams cannot withstand a loss, they will never be flyers."

Maris nodded. "And Liane is the one in doubt?"

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"I will not sponsor Liane," Sena said. "He is not ready. I wonder if he will ever be ready."

Maris was surprised. "I've watched him fly," she said. "He is strong, and at times he flies brilliantly. I grant you that he is moody and erratic, but when he is good he is better than S'Rella and Damen together. He might be your best hope."

"He might," Sena said, "but I will not sponsor him. One week he soars like a nighthawk, and the next he stumbles and tumbles like a child thrown into the air for the first time. No, Maris. I want to win, but a victory by Liane would be the worst thing that could happen to him. I would venture to bet that he would be dead within the year. The sky is no safe haven for one whose skills come and go with his moods."

Reluctantly, Maris nodded. "Perhaps you are wise," she said. "But who would be your possible fifth, then?"

"Kerr," Sena said. She set her bone needle aside, and inspected the shirt she had been working on, then spread it across her table and sat back to regard Maris evenly with her good eye.

"Kerr? He is nice enough, but he is nervous and overweight and uncoordinated, and his arms are not half as strong as they need to be. Kerr is hopeless, at least for the present. In a few years, perhaps..."

"His parents want him to race this year," Sena said wearily. "He has wasted two years already, they say. They own a copper mine on Little Shotan, and are most anxious for Kerr to have his wings. They support the academy handsomely."

"I see," said Maris.

"Last year I told them no," Sena continued. "This year I am less certain of myself. Without a victory in this competition, the academy may lose its support from the Landsmen. Then only wealthy patrons will stand between us and closing. Perhaps it is best for all to keep them happy."

"I understand," Maris said, "though I do not entirely approve. Still, I suppose it cannot be helped. And it will do Kerr little enough harm to lose. At times he seems to enjoy playing the clown."

Sena snorted. "I think I must do it. Yet I hate it. I had hoped you could talk me out of it."

"No," said Maris. "You overestimate my eloquence. I will give some advice, however. During these last weeks, reserve your wings solely for those who will challenge. They will need the seasoning. Occupy the others with exercises and lessons."

"I have done so in past years," Sena said. "They also race mock contests against each other. I would have you contest with them too, if only to teach them how to lose. S'Rella challenged last year, and Damen has lost twice, but the others need the experience. Sher..."

"*Sena, Maris, come quick!*" The shout came from the hall, and a breathless Kerr suddenly appeared in the doorway. "The Landsman sent someone, they need a flyer, they..."

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He panted, struggling with the words.

"Go with him, quickly," Sena told Maris. "I will hurry behind as fast as I am able."

The stranger who waited in the common room among the students was also panting; he had run all the way from the Landsman's tower. Yet speech seemed to burst from him. "You're the flyer?" He was young and obviously distraught, glancing about like a wild bird trapped in a cage.

Maris nodded.

"You must fly to Shotan. Please. And fetch their healer. The Landsman said to come to you. My brother is ill. Wandering in the head. His leg is broken—badly, I can see the bone—and he won't tell me how to fix it, or what to give him for his fever. Please, please hurry."

"Doesn't Seatooth have its own healer?" Maris asked.

"His brother is the healer," volunteered Damen, a lean youth native to the island.

"What's the name of the healer on Big Shotan?" Maris asked, just as Sena came limping into the room.

The old woman immediately grasped the situation and took command. "There are several," she said.

"Hurry," the stranger implored. "My brother might *die*."

"I don't think he'll die of a broken leg," Maris began, but Sena silenced her with a gesture.

"Then you're a fool for thinking so," the youth said. "He has a fever. He raves. He fell down the cliff face climbing after kite eggs, and he lay alone for almost a day before I found him. Please."

"There's a healer on the near end named Fila," Sena said. "She's old and crotchety and doesn't care for sea travel, but her daughter lives with her and knows her arts. If she can't come she'll tell you the name of another who can. Don't waste your time in Stormtown. The healers there will all want to weigh your metal before they gather their herbs. And stop at the South Landing and tell the ferry captain to wait for an important passenger."

"I'll go at once," Maris said, with only the briefest of glances for the stew pot that was steaming over the fire. She was hungry, but it could wait. "S'Rella, Kerr, come help me with my wings."

"Thank you," the stranger muttered, but Maris and the students were already gone.

The storm had finally broken outside. Maris thanked her luck, and flew straight across the salt channel, skimming a few feet above the waves. There were dangers in flying so low, but she had no time to try for altitude, and scyllas rarely came so close to land anyway. The flight was short enough. Fila was easy to find but—as Sena had predicted—reluctant to come. "The waters make me sick," she muttered sourly. "And that boy on Seatooth, he thinks he's better than me anyway. Always has, the young fool, and now he comes crying to me for help." But her daughter apologized for her, and

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soon after left for the ferry.

On the way back, Maris indulged herself, enjoying the sensuous feel of the winds as if to make up for the brusque way that she had used them to travel to Big Shotan. The stormclouds were gone now, the sun was shining brightly on the waters, and a rainbow arched across the eastern sky. Maris went in search of it, soaring up on a warm current of air that rose from Shotan, frightening a flock of summerfowl when she joined them from below. She laughed as they scattered in confusion, banking at the same time, her body responding out of habit to the subtle, shifting demands of the winds. They went in all directions, some towards Seatooth, some towards Eggland or Big Shotan, some out towards the open sea. And further out she saw—she narrowed her eyes, trying to be sure. A scylla, its long neck rearing out of the water to snap some unwary bird from the sky? No, there were several shapes. A hunting pack of seacats, then. Or ships.

She circled and glided out over the ocean, leaving the islands behind her, and very shortly she was sure. Ships all right, five of them sailing together, and when the wind had brought her closer she could see the colors as well, the faded paint on the canvas sails, the ragged streamers flapping and fluttering above, the hulls all black. Local ships were less gaudy; these had come a long way. A trading fleet from Eastern.

She swooped low enough to see the crew hard at work replacing sails, pulling in lines and shifting desperately to stay on the good side of the wind. A few looked up and shouted and waved at her, but most concentrated on their labors. Sailing the open seas of Windhaven was always a dangerous business, and there were many months in the year when travel between distant island groupings was made flatly impossible by the raging storms. To Maris the wind was a lover, but to the sailors it was a smiling assassin, pretending friendship only to gain the chance to slash a sail or drive a ship to splinters against an unseen rock. A ship was too large to play the games the flyers played; a ship at sea was always in a state of battle.

But these ships were safe enough now; the storm was past, and it would be sunset at least before another one would be upon them. There would be celebration in Stormtown tonight; arrival of an Eastern trade fleet this size was always an occasion. Fully a third of the ships that tried the hazardous crossing between archipelagos were lost at sea. Maris guessed the fleet would make port in less than an hour, judging from their position and the strength of the winds. She wheeled

There is something in man
which your ***science***
cannot satisfy.

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above them once more, made very aware of her grace and freedom in the sky by their struggles below, and decided to carry the news to Big Shotan instead of returning immediately to Seatooth. She might even wait for them, she thought, curious about their cargo and their news.

Maris drank too much wine in the boisterous tavern on the waterfront; it was pressed on her by the delighted customers, for she had been the first to bring word of the approaching fleet. Now everyone was at the docks, drinking and carousing and speculating about what the traders might be bringing.

When the cry went up—first one voice, then many—that the ships were docking, Maris stood up, only to lurch forward as she lost her balance, made dizzy by the wine. She would have fallen, but the crush of bodies around her, rushing towards the door, kept her upright and bore her along.

The scene outside was wild and noisy and for a moment Maris wondered whether she had been right to stay; she could see nothing, learn nothing in this excited, milling crowd. Shrugging, she slowly fought her way free of the mob, and sat down on an overturned barrel. She might as well stay out of it and keep her eyes open for anyone from the ship who could supply her with news. She leaned back against a smooth stone wall and folded her arms to wait.

She woke unwillingly, annoyed by someone who would not stop pushing at her shoulder. She blinked her eyes several times, looking up into the face of a stranger.

"You are Maris," he said. "Maris the flyer? Maris of Lesser Amberly?" He was a very young man, with the severe, sculpted face of an ascetic: a closed, guarded face which gave away nothing. Set in such a face, his eyes were startling; large, dark, and liquid. His rust-colored hair was pulled back sharply from a high forehead, and knotted in the back of his skull.

"Yes," she said, straightening. "I'm Maris. Why? What happened? I must have fallen asleep."

"You must have," he said flatly. "I came in on the ship. You were pointed out to me. I thought perhaps you had come to meet me."

"Oh!" Maris looked quickly around. The crowds had thinned and all but vanished. The docks were empty except for a group of traders standing on a gang plank, and a work-crew of stevedors unloading chests of cloth. "I sat down to wait," she muttered. "I must have closed my eyes. I didn't get much sleep last night."

"Of course," he said.

There was something naggingly familiar about him, Maris thought groggily. She looked at him more closely. His clothing was Eastern in cut, but simple; grey fabric without ornamentation, thick and warm, a hood hanging down behind him. He had a canvas bag under one arm and wore a knife in a leather sheath at his waist.

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"You said you were from the ship?" she asked. "Pardon, I'm still only half awake. Where are the other sailors?"

"The sailors are drinking or eating, the traders off haggling, I would say," he answered. "The voyage was difficult. We lost one ship to a storm, though all but two of the crew were pulled from the water safely. Still, conditions afterwards were crowded and uncomfortable. The sailors were glad to come ashore." He paused for a moment. "I am no sailor, however. My apologies. I made a mistake. I do not think you were sent to meet me." He turned to go.

Suddenly Maris realized who he must be. "Of course," she blurted. "You're the student, the one from Airhome." He had turned back to her. "I'm sorry," she said. "I'd forgotten all about you." She jumped down from the barrel.

"My name is Val," he said, as if he expected it to mean something to her. "Val of South Arren."

"Fine," Maris said. "You know my name. I'm sure—"

He shifted his bag uneasily. The muscles around his mouth were tense. "They also call me One-Wing."

Maris said nothing. But her face gave her away.

"I see you know me after all," he said, a bit sharply.

"I've heard of you." Maris admitted. "You intend to compete?"

"I intend to fly," Val said. "I have worked for this for four years."

"I see," Maris said coolly. She looked up at the sky, dismissing him. It was nearly dusk. "I've got to get back to Seatooth," she said. "They'll be thinking I fell into the ocean. I'll tell them you arrived."

"Aren't you even going to speak to the captain?" he asked sardonically. "She's in the tavern across the way, telling stories to a gullible crowd." He canted his head at one of the dockside buildings.

"No," Maris said, too quickly. "But thanks." She turned away, but stopped when he called after her.

"Can I hire a boat to take me to Seatooth?"

"You can hire anything in Stormtown," Marie answered, "but it will cost you. There's a regular ferry from South Landing. You'd probably be best to stay the night here and take the ferry in the morning." She turned again and moved off down the cobbled street, towards the flyers' quarters where she had stored her wings. She felt a bit ashamed of leaving him so abruptly when he had come so far in his desire to be a flyer, but she did not feel ashamed enough to turn back. One-Wing, she thought furiously. She was surprised he admitted to the name, and even more surprised that he would come to try again at a competition. He must know how he would be met.

"You *knew*!" Maris shouted, angry enough so that she did not care if the students heard her. "You knew and you didn't tell me."

"Of course I knew," Sena said. Her

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own voice was even, and her good eye was as impassive and fixed as her bad one. "I did not tell you because I expected you would react like this. My students needed your help. I could not risk your flying off in anger, especially since it was possible that Val would not even survive the ocean crossing."

"Sena, how could you?" Maris demanded. "Do you really intend to sponsor his challenge?"

"If he is good enough," Sena replied. "I have every reason to think he will be. I have serious qualms about sponsoring Kerr, but none whatsoever about Val."

"Don't you know how we feel about him?"

"We?"

"The flyers," Maris said impatiently. She paced back and forth before the fire, then paused to face Sena again. "He can't possibly win again. And if he did, do you think it would keep Woodwings open? The academies are still living down his first win. If he won again, the Landsman of Seatooth would..."

"The Landsman of Seatooth would be proud and pleased," Sena said, interrupting. "Val intends to take up residence here if he wins, I believe. It's not the land-bound who call him One-Wing—only your flyers do that."

"He calls *himself* One-Wing," Maris said, her voice rising once more. "And you know why he got the name. Even during the year he wore his wings, he was never more than half a flyer." She resumed her pacing.

"I'm less than half a flyer myself," the older woman said quietly, looking into the flames. "A flyer without wings can be a flyer only in dreams and memory. Val has a chance to fly again, and I can help him."

"You would do absolutely anything to have a woodwinger win in the competition, wouldn't you?" Maris said accusingly.

Sena turned up her wrinkled face, her good eye bright and sharp on Maris. "What did he do to make you hate him so?"

"You know what he did," Maris said.

"He won a pair of wings," Sena said.

She seemed suddenly a stranger. Maris spun away from her, turning her back on the older woman to avoid the blind stare of that white and hideous eye. "He drove a friend of mine to suicide," she said in a low, intense voice. "Mocked her grief, took her wings, and all but pushed her off that cliff with his own hands."

"Nonsense," Sena said. "Ari took her own life."

"I knew Ari," Maris said softly, still facing the fire. "She hadn't had her wings very long, but she was a true flyer, one of the best. Everyone liked her. Val could never have defeated her in fair flight."

"Val did defeat her."

"She talked to me at the Eyrie, just after her brother died," Maris said. "She had seen it all. He was out in his boat, the lines out for moonfish, and she was flying above, keeping an eye on him. She saw the scylla coming, but

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she was too far away, the winds tore the warning from her mouth. She tried to fly closer, but it wasn't in time. She saw the boat smashed to splinters, and the scylla's neck came craning up out of the water with her brother's body in its jaws. Then it dove. Her brother was all the family she had left."

"She should not have gone to the competition," Sena said simply.

"It was only a week off," Maris said. "She didn't intend to go, that day she was at the Eyrie, but she was so forlorn. Everyone thought it would help cheer her up. The games, the races, the singing and the drinking. We all urged her to go, never dreaming that anyone would challenge her. Not in her condition."

"She knew the rules the council set," Sena insisted. "The council *you* caused to be summoned, Maris. Any flyer who appears at the competition is subject to challenge, and no healthy flyer may absent himself more than two years running."

Maris turned back to face the teacher once again, scowling. "You talk of law. What of humanity, kindness? Yes, Ari should have stayed away. But she desperately wanted to go on with her life. She needed to be among her friends and forget her pain for a while. We watched over her. She was clumsy then, as if she often forgot where she was and what she was doing, but we kept her safe. She was enjoying the competition. No one could believe it when that boy challenged her."

"Boy," Sena repeated. "You used the right word, Maris. He was fifteen at the time."

"He knew what he was doing. The judges tried to explain things to him, but he would not withdraw his challenge. He flew well and Ari flew badly, and that was it. One-Wing had her wings. It was only a month later that she killed herself."

"Val was half an ocean away at the time," Sena said. "The flyers had no cause to blame him, and shun him so. And no cause to do what they did the year after, at the competition on Culhall. Challenge after challenge after challenge, from retired flyers and flyer-children just come of age, and the best and the most talented at that."

"There was no rule against multiple challenges at that time," Maris said defensively.

"I notice that there is such a rule now, though. Where was the fairness in that?"

"It didn't matter. He lost to the second challenger."

"Yes. A girl who had been practicing with wings since she was seven, whose father was the senior flyer on Little Shotan, was able to defeat him after he had already outflown one other challenger," Sena said. She made an angry noise and rose slowly from her chair. "And what incentive did he have to fly well against her? There was another waiting to challenge next, a dozen more after him. And you all told him he was only half a flyer anyway." She moved towards the door.

"Where are you going?" Maris de-

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manded in an angry voice.

"To dinner," Sena said gruffly. "I have news to tell my students."

Val arrived the next morning during breakfast. Sena sat at one bench, spooning up her eggs in a grim silence while the students glanced at her curiously. Maris was seated well away from the teacher, listening to S'Rella and brawny young Liane try to convince a third student—a plain, quiet woman named Dana, the oldest of the woodwingers—to remain at the academy. Last night at dinner, Sena had announced the names of the five she would sponsor in challenge. Dana, discouraged, was planning to return home and resume the life she had abandoned. S'Rella and Liane were not doing very well in their attempts to reconvert her. From time to time Maris would add a few words about the importance of desire, but she found it hard to really care. Truth was that Dana had begun much too late and had never had real talent anyway. She was probably just wasting her time, although Maris did not feel it was her place to say that.

All conversation ended when Val entered.

He took off his heavy woolen travelling cape and lowered his bag to the floor. If he took note of the sudden silence or the way the others stared at him, he gave no sign. "I'm hungry," he said. "Have you any extra food?"

That shattered the spell. Everyone began talking at once, and Leya fetched him a platter of eggs and a mug of tea, and Sena rose and went to him, smiling, and led him back to her table, to sit and eat at her side. Maris watched in silence, staring and feeling uneasy, until S'Rella tugged at the sleeve of her shirt.

"I said, do you think he will win again?" S'Rella asked.

"No." Maris said, too quickly and too loudly. She rose abruptly. "No one has lost a brother lately. How could he possibly win?"

That afternoon, he made her regret her words.

Sher and Leya had been up all morning, flying practice circuits while Sena yelled instructions at them from below and Maris observed them from the air. Val was unpacking and settling into his room. In the afternoon, S'Rella and Damen were supposed to have use of the academy wings, but Sena had asked one of them to yield to Val, since he had been grounded for months and needed the feel of the wind again. S'Rella had quickly volunteered.

It was crowded on the observation platform when he emerged, wings strapped to back and folded. Most of the students had come to see him fly. Maris, still winged, waited among them.

"Damen," Sena was saying, "I want you to practice skimming today. Fly as low over the water as you can. Keep your wings stiff and even. You wobble too much. You must improve, or some day you will fall in." She looked at her other student. "Val, you'd be best to just unlimber now.

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Later there will be time for other exercises."

"No," Val said. He was standing stiffly while two of the younger students unfolded and locked his wings. "I fly better when I *must* fly well. Set me a difficulty." He looked at Damen, who was flexing in preparation for flight. "Or give me a race."

Sena shook her head. "You are premature, Val. I will say when the time has come for racing."

But Maris pushed forward, possessed of a sudden urge to see how good the infamous Val One-Wing really was. "Let them race, Sena," she said. "Damen has had exercise enough. He needs a competition."

Damen looked from Maris to Sena and back again, clearly eager to race but unwilling to defy his teacher. "I don't know," he said.

Val shrugged. "As you will. I doubt you could give me much of a race in any case."

That was too much for Damen, who was fiercely proud of his status as one of Woodwings' best. "Don't flatter yourself. One-Wing," he snapped. He lifted an arm and pointed across the waters, to where the waves broke and foamed against a ridge of half-submerged stone. "When we are both aloft and Maris gives the word, three times and three times back. Agreed?"

"Agreed," Val said, studying the distant rocks.

Sena pursed her lips but said nothing. Hearing no further objections, Damen grinned and ran and leapt. The wind took him and lifted. He soared upward, did a stately circle over the shoreline, and passed above them, his shadow rippling across the stone. Val moved to the edge, his wings fully extended now.

"Your knife, Val," S'Rella said suddenly. The rest of them looked. His ornate blade, obsidian with beaten silver edges, was still in its sheath at his hip.

Val reached down and pulled it free, looking at it curiously. "What of it?"

"Flyer tradition," Sena said. "No blade may be carried into the sky. S'Rella, help him off with it. We will keep it safe for you."

S'Rella moved to obey, but Val gestured her away, "This was my father's knife, the only decent thing he ever owned. I carry it everywhere." He slid it back into its sheath.

"It's flyer tradition," S'Rella said, her voice puzzled, as if she couldn't quite understand.

Val smiled sardonically. "Ah. But I am only half a flyer. Move back, S'Rella." And when she moved back, he threw himself into the air.

Maris walked to the outer edge of the platform, to stand between Sena and S'Rella, all of them watching Val as he spiraled upwards to join Damen. Behind her, she could hear the others talking about him. "One-Wing," a voice said, Liane perhaps. Damen had called him that too, after Val had mocked him. The Easterner wasted no time making enemies, Maris thought. She said as much to Sena.

"The flyers wasted no time making an enemy of him," Sena replied. Even

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her bad eye was turned upward, towards the sky, where Damen and Val now wheeled in great circles around each other, like two birds of prey searching for a weakness. "You are to say the word, Maris," Sena reminded her.

Maris cupped her hands. "*Fly*," she shouted, as loud as she could shout it. The wind took it and carried it up to them.

Damen came out of his circle first, sweeping around and over the water in a slow, leisurely manner, as if he had all the time in the world. Val One-Wing came just behind him, wide silver wings weathervaning a bit, tilting first one way and then the other, as if he were not quite balanced. Both flyers kept low. Maris put a hand up to shade her eyes against the sunlight flashing from their wings.

Halfway to the first turn, Damen was widening his lead and Val began to rise. "The wind is picking up," Sena commented. Maris nodded. It felt like a crosswind as well. They'd have to fly; it would be no simple matter of letting the breeze carry them where they wished to go.

Damen reached the rocks well ahead of his competition, and began his turn. A ragged shout went up from the woodwingers. Damen was winning. But he lost time on his turn; he came around slow and too wide, faltering at one point when he faced head on into the wind, before he took command of it again. He seemed less steady coming back.

Val began to tack well before the turn, changing his course as he climbed, not all at once but in a series of small increments. He was much higher than Damen now, but substantially behind. When he came around at last, Damen was already halfway back. But Val's turn was sharper and cleaner than his rival's.

"Damen's beating him," Liane called out. Damen swept by above them. The students shouted again and waved. "Hey, Damen!" Liane bellowed, hands cupped around his mouth. "Go!" Damen came around slowly—again the turn was too wide—and dipped his wing to acknowledge the cheers, but the gesture cost him. He lost the wind for an instant and slid down sharply and dangerously and when he passed in front of them, suddenly the bulk of the great rock fortress was between him and the prevailing wind. He drifted lazily, losing speed, and had to struggle to pull himself back up again.

Val made no such mistake. He turned tightly, keeping high enough above them so he lost no portion of the wind, however small. And suddenly he seemed to be moving much faster as well.

"Val has won it," Maris said suddenly. She hadn't meant to speak aloud, but no sooner had it come to her than the words were out.

Sena was smiling. S'Rella looked baffled. "But, Maris, look. Damen is well ahead."

"Damen is just riding on the winds," Maris said. "Val is using them. He was searching for the right

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wind, and now he's found it. Watch, S'Rella."

It didn't take long. Damen's lead shrank steadily as the two flyers moved out towards the rocks once more, and the woodwinger slid badly off course when he tried to come around more sharply than before. By the time he'd corrected himself, Val had reached the turnaround point. A few moments later, Damen seemed to startle visibly as the shadow of Val's wings fell upon his own. Then the shadow moved in front of him.

The students were quiet, even Liane.

"Give him my congratulations," Maris said. She then turned and went back inside.

Her room was cold and damp. Maris built a fire in the hearth, and since it was going anyway, decided that she might as well heat the *kivas* she had bought in Stormtown. She was on her third cup, relaxing at last, when Sena entered unasked, and took a seat.

"How do the practices go?" Maris said.

"He has them all racing," Sena said. "Damen took it well enough, but he had no taste for another race, so he gave up his wings for the afternoon. They were all eager to try him." She smiled a bit, clearly proud of their eagerness. "He defeated Sher and Jan handily, humiliated Kerr and Egon. Egon almost fell into the ocean. S'Rella flew him a close race, though. Stole all the tricks he used to defeat Damen. She's a clever girl, S'Rella."

"He flew six races?" Maris said.

"Seven," Sena said, smiling. "Liane almost beat him. The wind is gusting now, very turbulent. It knocked Val around a bit. He's lean, not as strong as he could be. I'll have him work on that. Pull-ups, push-ups. And of course he was tired by then, but Liane insisted. Liane can handle rough winds. He's muscled like a scylla. Sometimes, the way he wrenches his wings around, I think he's yanking himself through the sky on sheer brawn. Val beat him anyway, though. Very close. Then Leya wanted to race, but the storm was about to break and I chased them all inside. What do you think of One-Wing now, Maris?"

Maris poured the teacher a mug of *kivas* while she thought about that one; Sena took it wordlessly, with a brief nod of thanks.

"I think he can fly," Maris said at last. "Beyond that, I don't know. I still don't like what he did to Ari. And I didn't like that business with his knife today, either. Yet I can't deny his skill."

"Will he win?"

Maris tasted her drink, let the sweet warmth flow down and into her. She closed her eyes briefly and leaned back. "Perhaps," she said. "I can think of a dozen flyers who don't handle themselves as well as he did today. I can also think of a dozen who are better than he, who know all his tricks and more. Tell me who he's to challenge and I'll tell you his chances. Beyond that—well, speed is only one

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skill of a flyer. The competition will judge grace and precision as well.

"Fair enough," Sena said. "Will you help me ready him?"

Maris stared down at the grey stone floor. "You place me in a difficult position," she said. "And for the sake of someone I don't even like."

"So only those you approve of deserve to fly?" Sena said. "Is that the principle you struggled for seven years ago?"

Maris raised her head, solemnly meeting Sena's gaze. "You know better. Those who fly best deserve the wings."

"And you admit Val is skilled," Sena said. She sipped at her *kivas* while she waited for an answer.

Maris nodded reluctantly. "But if he *should* win, the others will not forget the past. You call him Val, but he'll always be One-Wing to them."

"I am not asking you to fly guard on him for the rest of his career," Sena said tartly. "I ask only that you help me now, help Val to get his wings."

"What do you want me to do?"

"Nothing more than you have already done, for the others. Show him his mistakes. Teach him the things your years as a flyer have taught you, as you would teach a child of your own. Advise him. Push him. Challenge him. He is too skilled to gain much by pitting himself against my woodwingers, and you saw today how little he is willing to listen to me. I am old and crippled, and I fly only in my dreams. But you are an active flyer, and reputed one of the best. He will heed you."

"I wonder," Maris said. She drained the last inch of *kivas* from her mug and set it aside. "Well, I suppose I must give him my advice, if he will take it."

"Good," Sena said. She nodded briskly and stood up. "I thank you. Now, if you'll excuse me, I have work to tend to." Halfway to the door she paused and half-turned. "I know this is hard for you, Maris. Perhaps if you knew Val better, you might feel some sympathy between you. He admires you, I know."

Maris was startled, but tried not to show it. "I can't admire him," she said. "And the more I see of him, the less I see to sympathize with or like."

"He is young," Sena said. "His life has not been easy, and he is obsessed with winning back his wings—not so very different from you, some years back."

Maris choked down her anger to keep from launching into a tirade about how different Val One-Wing was from her younger self; she would only risk hurting the older woman and making herself look spiteful.

The silence lengthened, and then Maris heard Sena's soft, uncertain footsteps taking her away.

The next day the final training began.

From sunup until sundown the six challengers flew. Of those who would not compete this year, some went home to visit families on Seatooth or

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the Shotans or other nearby islands. The others, whose homes lay long dangerous distances away, sat perched on bare rock to watch their fortunate companions and dream of the day when they, too, would have a chance to win their own wings.

Sena stood below on the launching deck, shouting up advice and encouragement to her fledglings, sometimes leaning on a wooden cane, more often using it to gesture and command. Maris, winged, flew guard; circling, watching, yelling cautions. She put S'Rella, Damen, Sher, Leya, and Kerr through their paces, racing against them two at a time, calling upon them to perform the sort of aerial acrobatics that might impress the judges.

Val was given a chance to use a pair of wings as often as any of the others, but Maris found herself observing him in silence. He had been in competition twice before, she reasoned; he knew what would be expected. To treat him as she did the other woodwingers would be to condescend. But, mindful of her promise to Sena, she studied his flying closely, and that night at dinner she sought him out.

Only one hearth was lit in the common room, and the benches seemed strangely empty. When Maris arrived, one table was crowded with the students who would not be competing, and Sena sat at a second, talking in an animated fashion with Sher, Leya, and Kerr. S'Rella and Val were alone at the third table.

Maris let Damen fill her platter with his fish stew, then drew herself a glass of white wine and went to join them.

"How is the food?" she asked, as she sat down across from Val.

He looked at her evenly, but she could read nothing in his large, dark eyes. "Excellent," he said. "But even at Airhome, we never had cause to complain about the meals. Flyers eat well. Even those with wooden wings."

S'Rella, seated next to him, pushed a chunk of hookfin across her plate with marked indifference. "This isn't that good," she said. "Damen always makes everything so bland. You should be here when *I'm* cook, Val. Southern food has a lot of spices."

Maris laughed. "Too many, if you want my opinion."

"I'm not talking about spices," Val said. "I'm talking about food. This stew has four or five different kinds of fish in it, and chunks of vegetable, and I think there's wine in the sauce. There's plenty of it, and not a bit of it is rotten. Only flyers and Landsmen and rich traders would quibble about food like this."

S'Rella looked wounded. Maris frowned and put down her knife. "Most flyers eat simply, Val. We can't afford to get fat."

"I've been served fish that stank and meat crawling with worms," Val said coolly. "I've eaten fish stew that was entirely fishless, sometimes for months. I grew up on scraps and leavings from flyer plates. I will be happy to spend the rest of my life eating as *simply* as a flyer." There was an infinite amount of sarcasm in the way he

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said *simply*.

Maris flushed. Her own true parents had not been wealthy, but her father had fished the sea off Amberly and they had always had enough to eat. After his death, when she had been adopted by the flyer Russ, she had always had enough of everything. She drank some of her wine and changed the subject. "I wanted to talk to you about your turns, Val."

"Oh?" He swallowed his last piece of fish and shoved the plate away. It was perfectly clean. "Am I doing anything wrong, flyer?" His voice was so flat Maris found it difficult to tell if the sarcasm was still there or not.

"Not wrong, not exactly. But given a choice, I notice that you always turn downwind. Why?"

Val shrugged. "It's easier."

"Yes," Maris said. "But not better. You'll come out of a downwind turn with more speed, but it will also take more room. And you tend to roll more on a downwind turn, particularly in high winds."

"An upwind turn is difficult in high winds," Val said.

"It requires more strength," Maris agreed. "But you need to work on your strength. You should not avoid difficulty. A habit like always turning downwind may seem harmless, but the time will come when you *have* to turn upwind, and you should be able to do it well."

Val's expression was as guarded as ever. "I see," he said.

Emboldened, Maris raised a touchier subject. "Something else. I saw that you wore your knife again today during practice."

"Yes."

"Next time, don't," Maris said. "I don't think you understand. No matter what the knife means to you, this is a matter of flyer law. No blades may be worn in the sky."

"Flyer law," Val said icily. "Tell me, who gave the flyers the right to make laws? Do we have farmers' law? Glassblowers' law? The Landsmen make the law. The only law. When my father gave me that knife, he told me never to put it aside. But I did put it aside, during the year I had my wings. I obeyed your flyer law. It did nothing but shame me. I was still One-Wing. Well, I was a boy then, and cowed by flyer law, but I am not a boy now. I choose to wear my knife."

S'Rella looked at him wonderingly. "But, Val—how can you disregard flyer law, if you're going to be a flyer?"

"I never said I was going to be a flyer," Val replied. "Only that I intend to win wings, and fly." His eyes moved from Maris to S'Rella. "And, S'Rella, you are not going to be a flyer either, even if you should win. Remember that, if it comes to pass. You'll be as I was—a One-Wing."

"*That's not true*!" Maris said angrily. "I was not born of flyers, but they've accepted me all the same."

"Have they?" Val said. He smiled a thin, ironic smile, and rose from the bench. "You'll excuse me. I have to rest. Tomorrow I must practice my upwind turns, and I'll need all my

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strength for that."

When he was gone, Maris reached across the table to take S'Rella by the hand, but the girl gave her a troubled look and pulled away. "I have to go too," she said, and Maris was left alone.

She sat for a long time, thinking, and it was not until Damen approached her that she remembered the half-eaten meal on her plate. "Everyone else is gone," he said softly. "Are you going to finish, Maris?"

"Oh," she said, "no, I'm sorry. I'm afraid I got distracted and let it get cold." She smiled and helped Damen with the plates, then left him to clean up the common room and set off down the dank stone corridors in search of Val's room.

She found it after only one wrong turning, and her anger grew to a white heat as she walked; she was determined to have it out with Val. But it was S'Rella who answered her impatient knocking.

"What are you doing here?" Maris said, startled.

S'Rella hesitated, shy and uncertain. But Val's voice came from within the room. "She doesn't have to answer that," he said.

"No, of course not," Maris said, abashed. She had no right even asking, she realized. She touched S'Rella on the shoulder. "I'm sorry. Can I come in? I want to talk to Val."

"Let her in," Val said, and S'Rella smiled at Maris tentatively and opened the door.

Like all the rooms in the academy, Val's was small, damp, and cold. He'd lit a fire in the hearth to drive some of the chill away, but so far it had been only partially successful. Maris noticed how bare the room was, completely lacking in the personal touches and trinkets that would tell a visitor something about the person who lived here.

Val was on the floor before the fire, doing push-ups. He'd thrown his shirt over the bed and was exercising bare-chested. "Well?" he said, without slackening his pace.

Maris was staring, sickened by what she saw. The whole of Val's back was crisscrossed by lines and thin white scars, mementoes of long-ago beatings. She had to force her eyes from them to remember why she had come. "We need to talk, Val," she said.

He came bounding to his feet, smiling at her and breathing hard. "Hand me my shirt, S'Rella," he said. Then, after he had pulled it on, "What do you want to talk about?" His hair, unbound now, fell to his shoulders in a rust-colored waterfall, softening the severity of his face and giving him an oddly vulnerable look.

"May I sit?" Maris asked. Val gestured towards the only chair in the room, and when Maris sat in it, lowered himself onto the backless stool near the fire. S'Rella sat on the edge of the narrow bed. "I don't want to play games with you, Val," Maris resumed. "We have a lot of work to do together."

"What makes you think I am playing games?" he asked.

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Maris ignored that. "Listen to me," she said. "I realize that you are bitter towards the flyers. They made you an outcast, branded you with a mocking, insulting name, and stripped you of your wings perhaps unfairly, with multiple challenge. But if you let that poison your feelings towards all flyers, forever, you will be the loser for it. Win your wings back in the competition, and you will be living with, competing with, and associating with flyers for much of the rest of your life. If you refuse to allow them to be your friends, then you will have no friends. Is that really what you want?"

Val was unmoved. "Windhaven is full of people, and only a few of them are flyers. Or don't you count the land-bound?"

"Why are you so determined to be hateful? You waste no time making enemies. Maybe you feel the flyers have wronged you, and maybe you are right. But quarrels are seldom one-sided. Try to understand that. What you did to Ari was not without wrong, either. If you want to be forgiven for that, then forgive the flyers for what they did. Accept and you may also be accepted."

Val smiled his thin-lipped smile, but there was something insulting in the way he did it. "Why do you think I want to be accepted? Or forgiven? I've done nothing that requires forgiving. I'd challenge Ari again. Unfortunately, she isn't available this year."

Maris suddenly found herself speechless with rage.

"*Val*," S'Rella said in a small, shocked voice. "How can you say that? She *killed* herself."

"Land-bound die every day," Val told her, his voice softening a bit. "Some of them kill themselves too. No one makes a cause out of that, or sings about it, or avenges their squalid little suicides. You have to shield your own flank, S'Rella. My parents taught me that. No one else will do it for you." His eyes went back to Maris. "I knew your brother, you know," he said suddenly.

"Coll?" she said, surprised.

"He visited South Arren seven years ago, on his way to the Outer Islands. There was another singer with him, an older man."

"Barrion," Maris said. "Coll's mentor."

"They stayed a week or two, singing in the dockside taverns, waiting for a ship to take them further east. That was the first time I heard about you, Maris of Lesser Amberly. You were my hero for a time. Your brother sings a pretty little song about you."

"Seven years ago," Maris said. "That must have been right after the council."

Val smiled. "It was the first we had heard of it. I was around twelve, just short of the age when a flyer-child would be taking up his wings, but of course I had no hope of that. Until your brother came to my island and sang about you and your council and your academies. When Airhome opened a few months later, I was one

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of the first students. I still loved you then, for making it all possible."

"And what happened?"

Val half-turned on his stool, stretching his hands out toward the fire. "I grew disillusioned. I thought that you'd opened the world to everyone, where once it had belonged only to flyers. I felt such a kinship with you. I was naive."

He turned back again, and Maris shifted uncomfortably under his intense, accusing gaze. "I thought we were alike," he continued. "I thought you wanted to break open the rotten flyer society. I found out I was wrong. All you ever wanted was to be a part of the whole thing. You wanted the fame and the status and the wealth and the freedom, you wanted to party on the Eyrie with the rest of them and look down on the dirt-digging land-bound. You embrace what I despise.

"The irony of it, though, is that you can't be a flyer, no matter how much you want to. No more than I can be a flyer, or S'Rella here, or Damen, or any of the rest of them."

"I *am* a flyer," Maris said quietly.

"They let you play at it," Val said, "because you try so very hard to fit in, to be *just like them*. But both of us know that they don't really trust you, or accept you as they'd accept one of their own. You have your wings, but you're still suspect, aren't you? Whether you admit it or not, you were the first One-Wing, Maris."

Maris stood up. His words had made her furious, but she didn't want to lash out at him or lose her dignity by quarreling with him in front of S'Rella. "You're wrong," she said as calmly and quietly as she could manage. But then she found she had no words to refute him with. "I feel sorry for you, Val," she continued. "You hate the flyers and you have contempt for the land-bound. For everyone who is not yourself. I don't want your respect or your gratitude. It's not just the privileges of flyer society you're rejecting, it's the responsibilities as well. You're totally selfish and self-absorbed. If I hadn't promised Sena, I'd have nothing more to do with helping you get your wings. Good night."

She left the room. Val did not move or call her back. But as the door swung shut behind her, she heard him speak to S'Rella. "You see," he said flatly.

And that night the dream came to Maris again, and she twisted and fought and woke with the bedclothes wrapped about her and soaked with clammy sweat. It had been worse than before. She had been falling, falling, falling endlessly through still air, and all around were other flyers, soaring on their silver wings and watching, and not one of them moved to help.

Day after day the practice continued.

Sena grew hoarse and intense and short-tempered, and presided over all like a tyrannical Landsman. Damen sharpened his turns and heard long lectures every day on flying with his head and not just his arms. S'Rella worked on launchings and landings

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and acrobatics, looking for grace to match her stamina. Sher and Leya, already graceful, stayed in the air for hours at a time in high winds, trying to build up a powerful endurance. Kerr worked on everything.

And Val One-Wing did what he would. Maris watched him from afar, as she watched all of them, and said little. She answered what questions he had, gave advice on the rare occasions that he asked for it, and treated him always with careful, distant courtesy.

Sena, absorbed entirely in the flying of her protegés, noticed none of it, but the woodwingers picked up their cues from Maris, and carefully kept their distance from Val. He aided the process himself; he had a sharp tongue and no compunction about making enemies. He told Kerr to his face that he was hopeless, sending the boy into a fit of sulking, and he mocked proud, stubborn Damen endlessly, defeating him again and again in informal races. The students, led by Damen and Liane and a few others, soon began calling Val "One-Wing" openly. But if that bothered him, he gave no sign.

Val's isolation was not quite total. If the others shunned him, he had at least S'Rella. She was more than merely polite to Val: she sought him out, asking for his advice, ate with him, and always, when Sena paired students off to race, S'Rella was the first to challenge Val.

Maris saw sense in her actions; pitting her skills against those of a stronger flyer would help her learn and overcome her weaknesses faster than anything else. And S'Rella, Maris knew, was determined to win her wings this year. There were other, less practical, reasons why S'Rella might be drawn to Val as well. The shy Southern girl had always been a bit out of place among the woodwingers, all of whom were Westerners; she cooked differently, dressed differently, wore her hair differently, spoke with a slight accent, even told different tales when the students gathered together for storytelling. Val One-Wing, from Eastern, was similarly displaced, and it was natural, Maris told herself, that the two odd birds would fly together.

Still, it made Maris uneasy to see the two talking together. S'Rella was young and impressionable, and Maris did not want her picking up Val's ideas. Besides, too close an association with One-Wing would make her unpopular among the other flyers, and S'Rella was vulnerable enough to be hurt by that.

But Maris pushed those worries to the back of her mind and did not interfere. There was no time now for personal fretting; she had to train these woodwingers for the real thing.

At the end of every day of training Maris raced each student individually. On the second day before the scheduled departure for the competition, the wind was strong from the north, and its cold edge seemed to slice through the shivering students. It grew colder by the minute.

"You don't need to wait," Maris told them. "It's too cold for standing

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around. After I race you, help the next student with the wings, and then you can go on inside."

The exertion of flying kept Maris warm, but it also tired her. Finally, bone weary and beginning to really feel the cold, Maris saw that she was alone on the flyer's cliff with Val.

Her shoulders slumped. She had not expected him to wait. And to race him now, when he was fresh and she was so tired.... She looked up at the swirling purple sky and licked dried salt from the corners of her mouth.

"It's late for flying," she said. "The winds are wild and it's getting dark. We can race another time."

"The winds will make it that much more of a challenge," Val said. His eyes rested coolly on hers, and Maris knew, with a sinking heart, that he had been waiting a long time for this moment.

"Sena may worry," she began weakly.

"Of course, if flying against the woodwingers has worn you out..."

"I once flew thirty hours without a rest," she said, stung. "An afternoon of play doesn't wear me out."

His smile mocked her: she saw that she had fallen into his trap.

"Get your wings on," she said.

She did not offer to help him, but it was obvious that he was accustomed to putting on his wings unaided. Maris tried unobtrusively to flex some resilience back into her muscles, telling herself that a victory for him, with her as tired as she was and the winds so capricious, would mean nothing. And he must know that.

"The usual? Twice out and back?"

Maris nodded, glancing across the grey, churning waves to the distant spire of rock they all used as a marker. How many times had she flown out there today? Thirty? More? It didn't matter. She'd fly the last two laps as if they were the first; her pride insisted.

"Who will judge us?" she asked.

Val snapped the last two joints of his wings into place. "We'll know," he said. "That's all that matters. I'll launch first, you call ready. Agreed?"

"Yes." She watched as, with a few swift steps, Val moved to the edge of the cliff and leapt outward. His body bobbed on the conflicting winds like a small boat on rough water until he took command, veered off to the right, and began to climb.

Maris took a breath and let her mind clear. She ran lightly forward and pushed off. For one brief moment she fell; then her wings caught the winds and she was buoyed upward. She took her time coming to Val's level, climbing in a ragged spiral, needing those few moments to get the feel back, so her tired body would know how best to use the winds.

When she came up to him, the two of them circled warily, around and around each other, struggling to hold position amid the restless winds. Her eyes met his, and then she looked away, straight ahead, towards the rock that was their marker.

"Ready...go," she shouted, and they were off.

The winds were strong and tur-

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bulent, the prevailing north wind interrupted by gusts from one direction, then from another. The whole eastern sky was a mass of darkening clouds, towering grey shapes that threatened storm weather. Maris gave them an uneasy glance and started to climb again, looking for a steadier, faster wind in the heights. She fought constantly to keep on course; the gusts pushed her first one way, then another, demanding constant attention and frequent half-turns and corrections. She could not afford any detours.

Although she did not look for him, she often caught sight of Val. He sometimes flew below her, but more often he was beside her, disconcertingly close. He flew well, and it did not help Maris to reflect that he was using the advice she had given him. There would be nothing easy or simple about defeating him, she thought.

Then Val surged ahead.

A shock of adrenalin coursed through Maris and she flung her body to the left to catch the changing wind that had given him his push. They might call him One-Wing, but he knew how to use both wings in the air. Flying races against woodwingers had made her soft, Maris thought. Her responses had been dulled.

Ahead of her, just barely out of reach, Val's wings swept around the spike of rock. He turned downwind, Maris noted, coming around wide and rocking just a little, but picking up speed as he did so. Then he was headed back towards the cliff.

Determined to overtake him, Maris flew dangerously close to the rock. Her wing-tip grazed the spire and that slight scraping threw her sideways, off balance for a crucial moment. She sheared downward crookedly, the wind lost to her, stalling, her heart pounding in her throat, before she finally gained control again. Val had put more distance between them. She was only grateful that he hadn't seen her blunder.

She had lost altitude, but she caught a strong updraft above the rocks, and suddenly Maris was rising again. She flew recklessly, thinking only of the immediate need for speed, searching and shifting until she found a steady current she could use.

It moved her close to Val, but she was so intent on passing him that she barely noticed the approach of land, and abruptly she was clutched by a sinker, a cold pocket of air that yanked her down like an icy hand from below. Val somehow flew clear of it, found some impossible lift that shoved him up and further ahead while Maris checked her abrupt descent and banked to free herself from the downdraft. He circled above the fortress, gauging the winds by the thin smoke rising from the academy's chimneys, and was on his way back out again, higher and higher, before Maris had finished her recovery.

It was as if the sky favored Val this evening, Maris thought resentfully as she came around. The winds toyed with her and stalled her, gusting unpredictably every time she tried to ride

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them, but let Val fly them freely. He seemed almost unaware of the dangerous uncertainty of the gales, somehow finding, amid constant shifting, the sure and fluid wind on which to glide.

Maris knew then that she had lost the race. Val was high above her, knowing that altitude often meant speed, and it would take her too long to reach his height, even if she should find the winds she needed to take her there. She tried to make up the distance between them, but the struggle against the ragged gusts wore her out, and the awareness that already it was too late took the heart out of her efforts. Val lost some time descending for his landing, but still passed above the cliff the second, final time more than a full wingspan ahead of her. Clearly, he had won.

Maris was too drained by the flight to smile at him when they had both come down in the soft sand of the landing pit, too depressed to pretend that it didn't matter. In silence, she removed her wings as hastily as she could, her numbed fingers often slipping and fumbling uselessly at the straps. At last, without a word having passed between them, Maris slung her wings over her shoulder and turned towards the weathered fortress.

Val blocked her way.

"I won't tell anyone," he said.

Her head jerked up, and she felt a hot flush of embarrassment rise in her cheeks. "I don't care what you say—about anything—to anyone!"

"Oh?" His faint smile taunted her, made her realize how hollow her words rang. Obviously she *did* care.

"It wasn't a fair trial," she snapped, and instantly regretted the feeble, childish complaint.

"No," Val agreed, his tone flat enough so Maris had no clue as to whether irony was intended. "You were flying all day, while I was well-rested. I could never have beaten you if we were both fresh. We all know that."

"I've lost before," Maris said, trying hard to control her emotions. "It doesn't bother me."

"I see," said Val. "Good." He smiled again.

Maris shrugged irritably, feeling the wings scrape her back. "I'm very tired," she said. "Please excuse me."

"Certainly," Val moved out of her way and she trudged past him, crossed the sand wearily, and began climbing the flight of worn, moss-covered steps that led to the fortress' seaward entrance. But at the top, some impulse made her hesitate and turn before ducking inside.

Val had not followed her. He still stood out on the sand, a gaunt solitary figure in the gathering dusk, his folded wings propped lightly on one shoulder. He was looking off over the sea, where a lone scavenger-kite sailed in ragged circles against the clouds of sunset.

Maris shivered and went inside.

The yearly competition was a festive three-day affair. Once it had been only games and drinking, with nothing at stake except pride. In those

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days it was smaller, and traditionally held on the Eyrie. But since the challenge system had been instituted seven years ago, flyer participation had grown dramatically, and it had been necessary to move the competition to the islands.

The Landsmen competed for it eagerly, donating facilities and labor. It was a holiday for their own people, and brought crowds of visitors with good metal coin from other islands. The land-bound had few spectacles like it, and the flyers were still figures of romance and adventure to many of them.

This year the contests were to be held on Skulny, a mid-sized island to the northeast of Little Shotan. Seatooth's Landsman had chartered a ship for Sena and the woodwingers, and a runner had just brought word that it was waiting at the small island's only port. They would sail on the evening tide.

"Setting out in the dark," Sena grumbled, taking a seat beside Maris at breakfast. "Asking for trouble."

Kerr looked up from his porridge. "Oh, but we have to leave on the tide," he said earnestly. "That's why we leave in the evening."

Sena regarded him sourly with her good eye. "Know a lot about sailing, do you?"

"Yes, ma'am. My brother Rac captains a trading ship, one of the big three-masters, and my other brother is a sailor too, though he's only a hand on a channel ferry. I thought that I—well, before I came to Woodwings, I thought I'd be a sailor too. It's about the closest thing there is to flying."

Sena shuddered. "Like flying without control, like flying with weights dragging you into the sea, like flying blind, yes, that's sailing."

She'd been speaking loud enough for everyone to hear, and there was widespread laughter around the room. Kerr blushed and concentrated on his bowl.

Maris looked at Sena with sympathy, trying not to laugh for Kerr's sake. She knew too well the flyer hatred of entrusting life to the sailors—Sena, although grounded for years, had still never lost the flyer's almost superstitious fear of travelling by sea.

"How long will it take?" Maris asked.

"Oh, they say, winds willing, three days, with a stop in Stormtown. What does it matter? Either we'll get there, or we'll all drown." The teacher looked at Maris. "You fly to Skulny today?"

"Yes."

"Good," Sena said, reaching across to take Maris by the arm. "Then everyone need not drown. We have two sets of wings we'll be needing in the competition. It would be insane to take them in the boat with us—"

"Ship," Kerr interrupted.

Sena looked at him. "Whatever," she said. "Boat or ship, it would be insane. We might as well put them to use. Will you take two of the students with you? The long flight should be good practice."

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Maris looked down the table and saw how everyone within hearing distance had suddenly become still. No spoons were raised, no jaws moved as they waited for her answer.

"That's a fine idea," Maris said, smiling. "I'll take S'Rella with me, and—" She hesitated, trying to decide who to choose.

Two tables down, Val set down his spoon and rose. "I'll go," he said.

Maris' eyes met his across the room. "S'Rella and Sher or Leya," she said stubbornly. "They need that kind of flight the most."

"I'll stay with Val, then," S'Rella said quietly.

"And I'd rather go with Leya," Sher added.

"It will be S'Rella and Val," Sena said irritably, "and I'll hear no more about it. If the rest of us die at sea, they have the best chance of becoming flyers and honoring our memory." She pushed aside her porridge bowl and turned on the bench. "Now I must go see our patron the Landsman and be obsequious to her for a while. I will see you again before you leave for Skulny."

Maris scarcely heard her; her eyes were still locked with Val's. He smiled at her thinly, then spun and followed Sena from the room. S'Rella left soon after.

Kerr was talking to her, Maris suddenly realized. She shook herself back to attention and smiled at him. "Sorry, I didn't hear you."

"It isn't so dangerous," he said quietly. "Not just to sail from here to Skulny. There's only a few miles of open ocean, when the ship crosses from Little Shotan to Skulny. Mostly we'll hug the shores of the Shotans, with land never out of sight. And the ships aren't as fragile as she thinks. I know about ships."

"I'm sure you do, Kerr," Maris said. "Sena is just thinking like a flyer. After the freedom of having your own wings, it's hard to travel by sea and trust your life to those handling the sails and the tiller."

Kerr chewed his lip. "I guess I see," he said, without conviction. "But if the flyers all think that, they don't know much. It's not as dangerous as she says." Satisfied, he went back to his breakfast.

Maris grew thoughtful, as she ate. He was right, she realized with a sense of vague unease; flyers were often limited in the ways they thought, judging everything from their own perspective. But the idea that Val's sweeping condemnation of them might have some justice to it disturbed her more than she was willing to admit.

She shrugged it off and finished. Afterwards, she helped Sher and Leya with the cleaning-up, and tried to answer their eager questions about what the competition would be like this year. At last she got away and went to look for S'Rella and—reluctantly—Val.

Neither of them were in their room, nor in any of the other obvious places, and no one seemed to know where they had gone after leaving the common room. Maris wandered through

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the dark, cool corridors until she was thoroughly lost, making her choice of turning according to whether or not there were torches for her to light in the wall-sockets.

She was thinking of giving out a cry for help, and laughing at herself for being so helpless within the enclosure of walls, when she heard, very faintly, the sound of voices, and pressed on. One more turn to the right and she found them, together, sitting close in a small cul-de-sac with a window overlooking the sea. There was something in the way they leaned near to each other that spoke of intimacy, and it changed Maris' mood to one of annoyance.

"I've been looking all over for you," Maris said abruptly.

S'Rella half-turned from Val and stood up. "What is it?" she asked.

"We're flying to Skulny, you know," Maris said. "Can you be ready to leave in an hour? Anything you wanted to take with you, you can pack up and give to Sena."

"I can be ready to leave in a minute," S'Rella said, and her smile put a damper on Maris' pique. "I was so happy when you named me, Maris. You don't know what this means to me." Her face alight, she leaped forward and embraced Maris.

Maris hugged her back. "I think I do," she said. "Now, go off and get ready."

S'Rella bid a brief goodbye to Val and then was off. Maris stood watching her go, and then turned back to him and hesitated.

Val was still looking down the tunnel where S'Rella had disappeared, smiling, but there was something about him—the smile was real, Maris realized. That was it. He was smiling with something like fondness, and it gave him a softer, more human look than she had ever seen him wear.

Then his eyes snapped back to her, and the smile changed, subtly, a small twist at the corners, and now he was smiling for Maris and the smile was full of derision and hostility. "I haven't thanked you for naming *me*," he said. "I was *so* happy when you said I could fly with you."

"Val," Maris said wearily, "we may not like each other, but we have a long flight to make together. You could at least try to be civil. Don't mock me. Are you going to pack?"

"I've never unpacked," he said. "I'll give my bag to Sena, and wear my knife. It's the only thing that matters. Don't worry, I'll be ready." He hesitated. "And I won't bother you on Skulny. When we land, I'll find my own quarters. I can amuse myself for a few days without imposing on you and your flyer friends. Fair enough?"

"Val," Maris started. But he had turned away and was staring through the cell's small window at the moving, cloudy sky, his face cold and closed.

Sena brought the others out to the launching cliff to watch Maris, S'Rella, and Val depart. All of them were in the highest of spirits, laughing and joking, vying with each other for the privilege of helping Maris and

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S'Rella with their wings. There was a mood of wild and restless gaiety among them that was infectious; Maris felt her own spirits rise, and for the first time she was eager for the competitions.

"Let them be, let them be!" Sena cried, laughing. "They certainly can't fly with the lot of you hanging on their wings!"

"Wish they could," mumbled Kerr. He pushed at his nose, which had turned bright red in the wind.

"You'll have your chance," S'Rella said, sounding defensive.

"No one grudges you this," Leya said quickly.

"You two are the best of us," Sher added.

"Save it," Sena said, putting one arm around Leya, the other around Sher. "Go now. We'll wave goodbye and meet you again on Skulny."

Maris turned to S'Rella and saw that the younger woman was watching her intently, her whole body tensed and ready for Maris' slightest signal. She remembered her own earliest flights, when she had still not quite believed that she could have wings of her own, and she touched S'Rella's shoulder and spoke to her kindly.

"We'll all stay close together and take it easy," she said. "The stunts are for the competitions—right now, we'll concentrate on steady flying. This will be a long trip for you, I know, but don't worry about it—you've got enough stamina for twice the distance. Just relax and trust yourself. I'll be there watching out for you, but you won't really need me."

"Thank you," S'Rella said. "I'll do my best."

Maris nodded and signaled, and Damen and Liane came out and unfolded her wings for her, strut by strut, pulling the bright silver fabric taut until her wingspan spread twenty feet. Then she was off, leaping away from the cliff to a chorus of farewells and good wishes, into the cool, steady, faintly rain-scented flow of the wind. She circled and watched S'Rella's takeoff, trying to judge it as if S'Rella were in competition.

No doubt about it. S'Rella had improved greatly recently. The clumsiness was gone, and she did not hesitate at the edge, but sprang smoothly clear of the fortress and, having judged the wind nicely, began to rise almost at once.

"I don't believe your wings are of wood at all!" Maris called to her.

Then both of them swung through the sky in impatient, widening circles, waiting for Val.

He had been leaning against the door through all of the joking and the preparations, standing outside it all, his face blank and guarded. He was winged already, having strapped them on without help. Now he walked calmly through the group of students and would-be flyers, and stood perched on the brink of the precipice, his feet half-over the edge. Painstakingly he unfolded the first three struts, but he did not lock them into place. Then he slid his arms through the loops, flexed, knelt and stood again.

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Damen reached to help him unfold his wings, but Val turned and said something sharp—Maris, circling above, lost the words in the wind—and Damen fell back in confusion.

Then Val laughed, and jumped.

S'Rella trembled visibly in the air, her wings shaking with her shock. Below, Maris heard someone scream, and someone else was swearing.

Val fell, body straight, like a diver's, ten feet down, twenty...

And suddenly he was falling no more, the wings came out of nowhere, flaring, flashing silver-white in the sun as they sprang open almost with their own volition. The air screamed past them, and Val caught it and turned it and rode on it, and all at once he was flying, skimming the breakers with impossible speed, then pulling up, climbing, soaring, the waves and the rocks and death all receding visibly beneath him, and Maris could hear dimly the peal of his triumphant wind-blown laughter.

S'Rella had locked into a stall, still watching Val. Maris shouted commands at her, and she broke out of it, twisting her wings at an angle and slanting off back over the land. Above the fortress, its bare rock heated in the sun, she found a strong riser and sailed back up to safety.

Below, Sena was cursing up at Val and shaking her cane in apoplectic fury. He paid no attention. He was rising, higher and higher, and from the woodwingers on the cliff came the ragged popping sound of applause.

Maris went after him, banking, breaking her circle, heading out over the sea. Val was already ahead of her. But flying easily this time, luxuriating in his stunt.

When she caught him, flying as near to him as she dared—above and a bit behind and to the right—she began to shout curses down at him, borrowing freely from Sena's more extensive vocabulary.

Val laughed at her.

"That was dangerous and useless and stupid," Maris shouted. It was not the first time she had seen the stunt. Once, when she was just a child, she had watched a flyer long dead perform it at the Eyrie. But that was a decade past, and she had seen it then with a child's eyes, as the woodwingers saw it today. Now she saw it differently. "You could have killed yourself...a jammed strut...if you hadn't flung them hard enough..."

Val still laughed. "My risk," he shouted back. "And I didn't fling them...rigged springs...better than Raven."

Raven: the name startled her. Raven was the flyer who had invented that trick, oiling his wing struts and flinging them away as he fell, each strut jarring loose the next as it snapped into place. But how had Val learned of Raven? "Raven was a fool," she shouted. "And long dead...what's Raven to you?"

"Your brother sang *that* song, too," Val yelled. Then he banked and dove, away from her, abruptly terminating the conversation. But Maris understood. She had witnessed Ra-

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ven's Fall at the Eyrie, and told her brother Coll of it, and later Coll had made it into a song, one of the first that was entirely his own.

Numb, and seeing no use in further pursuit of Val, Maris wheeled around and looked for S'Rella, who was following several hundred yards behind and below them. She drifted down to join her, trying to tell her pounding heart to relax, willing her stiff muscles to loosen and get the feel of the wind.

S'Rella was ghost pale, and flying badly. "What *happened*?" she cried when Maris approached. "I could have *died.*"

"It was a stunt," Maris called to her. "Flyer named Raven used to do it. Val concocted his own version."

S'Rella flew silently for a moment, considering that, and then a little color came tentatively back into her face. "I thought someone had pushed him," she shouted. "A stunt—it was beautiful."

"It was *insane*," Maris called back. She was quietly horrified that S' Rella could possibly have thought one of her fellow students capable of shoving Val to his death. He *has* been influencing her, she thought bitterly.

The rest of the flight, as Maris had predicted, was easy. Maris and S'Rella flew close together, Val ahead and much higher, preferring the company of rainbirds, it seemed. They kept him in sight throughout the afternoon, but only with an effort.

The winds were cooperative, blowing them so steadily towards Skulny that they hardly needed to do more than relax and glide. It was at times a dull flight, but Maris did not regret it. They skirted the coast of Big Shotan, fishing fleets everywhere beyond the little harbor towns, bringing in as big a catch as possible in the storm-free weather. And they saw Stormtown from the air, its great bay in the center of the city, windmills turning all along the shores, forty of them, or fifty—S'Rella tried to count them, but they were behind her before she was half done. And in the open sea between Little Shotan and Skulny, near sunset, they spied a scylla, its long neck craning up out of the blue-green water as its rows of powerful flippers churned just beneath the surface. S'Rella seemed delighted. She had heard about scyllas all her life, but this was the first she had actually seen.

They reached Skulny just ahead of the night. As they circled before landing, they could see figures below setting up lanterns on poles all along the beach, to guide in later flyers. Already the small flyers' lodge nearby was ablaze with lights and activity: the parties, thought Maris, began earlier every year.

Maris tried to make her landing an example to S'Rella, but even as she was on her hands and knees, shaking sand out of her hair, she heard S'Rella thump to the ground nearby, and realized the girl had surely been too busy with her own landing to notice how clumsy or adept her teacher was.

Whoops of pleasure and welcome surrounded them at once. Eager

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hands reached out to them. "Help you, flyer? Help you, please?"

Maris took hold of one strong hand, and looked up into the eager face of a young boy with wind-tangled hair. His face was alive with pleasure; he was here for the glory of being near flyers, and was probably thrilled by the thought of the coming competition on his own island.

But as he was helping her off with her wings—and another boy was helping S'Rella—suddenly there was the sound of wind-on-wings again, and another thump, and Maris glanced over to see that Val had come in. They had lost sight of him near dusk, and she had assumed he was already down.

He climbed awkwardly to his feet, the great silver wings bobbing on his back, and two young girls moved in on him. "Help you, flyer." The refrain was almost a chant. "Help you, flyer," and their hands were on him.

"*Get away,*" he snapped, anger in his voice. The girls jumped back, startled, and even Maris looked up. Val was always so cool and controlled; the outburst was totally unlike him.

"We just want to help you with your wings, flyer," the bolder of the girls said.

"Don't you have any pride?" Val said. He was unstrapping himself, without help. "Don't you have anything better to do than fawn over flyers who treat you like dirt? What are your parents?"

The girl quailed. "Tanners, flyer."

"Then go and learn tanning," he said. "It's a cleaner trade than slaving for the flyers." He turned away from her, began to fold up his wings carefully.

Maris and S'Rella were free of their own wings now. "Here," said the boy who had been helping her, as he offered them to her, neatly folded. Suddenly abashed, Maris fumbled in her pocket and offered the boy an iron coin. She had always accepted the help without payment before, but something in what Val said had struck a chord.

But the boy just laughed and refused to take her money. "Don't you know," he said, "it's good luck to touch a flyer's wings." And then he was off, and Maris saw as he darted towards his companions that the beach was full of children. They were everywhere, helping with the poles, playing in the sand, waiting for the chance to aid a flyer.

But looking at them, Maris thought of Val, and wondered if there were others on the island who were *not* so thrilled by the flyers and the competition; who stayed home to brood and sulk and resent the privileged caste that flew the skies of Windhaven.

"Take your wings, flyer?" a voice said sharply, and Maris glanced over. It was Val, mocking. "Here," he said, in his normal tone, and he offered her the wings he'd worn on the flight. "I imagine you'll want these for safekeeping."

She took the wings from him, holding one pair awkwardly in each hand. "Where are you going?"

Val shrugged. "This is a fair-sized

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island. Somewhere there's a town or two, and a tavern or two, and a bed to sleep in. I have a few irons."

"You could come up to the lodge with S'Rella and me," Maris said hesitantly.

"Could I?" Val said, his voice perfectly level. His smile flickered at her. "That would be an interesting scene. More dramatic than my launching today, I'd guess."

Maris frowned. "I haven't forgotten that," she said. "S'Rella could have hurt herself, you know. She was badly startled by that fool's leap of yours. I ought—"

"I believe I've heard this before," Val said. "Excuse me." He turned and was gone, walking quickly up the beach with his hands shoved deep in his pockets.

Behind her, Maris heard S'Rella laughing and talking with the other young people, sharing her delight in her first long flight. When Maris approached, she broke off and ran to take her hand. "How was I?" she asked breathlessly. "How did I do?"

"You know how you did—you just want me to praise you," Maris said, her tone a mock-scold. "All right, I will. You flew as if you'd never done anything else in your life, as if you'd been born to it."

"I know," S'Rella said shyly. Then she laughed in sheer joy. "It was marvellous. I never want to do anything but fly!"

"I know how you feel," Maris said. "But a rest will do us good right now. Let's go in and sit by the fire and see who else has come early."

But when she turned to go, S'Rella hung back. Maris looked at her curiously, and then understood; S'Rella was worried about the sort of reception she would find inside the lodge. She was an outsider, after all, and no doubt Val had been filling her with tales of his own rejection.

"Well," Maris said, "you might as well come in, unless you feel like flying back tonight. They'll have to meet you sometime."

S'Rella nodded, still a bit timorous, and they started up the pebbled incline towards the lodge.

It was a small two-room building of soft, weathered white rock. The main room, well-lit and overheated by a roaring fire, was noisy, crowded, and unappealing after the clean solitude of the open air. The faces of the flyers seemed to blur together as Maris looked around in search of special friends, S'Rella standing nervously behind her. They hung the wings on hooks along the walls, and began to fight their way across the room.

A heavy-set, middle-aged man with a full beard was pouring some liquid into the huge, fragrant stewpot hung over the fire, and roaring insults at someone demanding nourishment. Something drew Maris' eyes back after they had passed over him, and with a strange little shock she recognized the overweight cook. When had Garth grown so old and fat?

She started towards him when thin arms went around her from behind, hugging her fiercely, and she caught

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the faint whisper of a flowery scent.

"Shalli!" she said, turning. She noticed the rounded stomach. "I didn't expect to see you here—heard you were preg—"

Shalli stopped her lips with a finger. "Hush. I get enough of that from Corm. And I tell him that our little flyer has to learn about flying from the very beginning. But I am careful, truly. I took the flight slow and easy. I couldn't miss this! Corm wanted me to take a boat. Can you imagine?" Shalli's beautiful, mobile face went from one comic expression to another as she spoke

"You're not going to compete?"

"Oh, no. It wouldn't be fair, me with the extra ballast!" She patted the small mound and laughed. "I'm to judge. And I've promised Corm that after this I'll stay home and be a good little mother 'til the baby comes, unless there's an emergency."

Maris felt a pang of guilt, knowing that the 'emergencies' Shalli had to fly were caused by her own absence from Amberly. But after the competition, she swore to herself, she'd stay home and tend to her duties.

"Shalli, I'd like you to meet a friend of mine," Maris said. S'Rella was hanging back shyly, so Maris pulled her gently forward. "This is S'Rella, our most promising student. She flew here from Woodwings with me today, her longest flight so far."

"Ooh." Shalli arched her brows.

"S'Rella, this is Shalli. From Lesser Amberly, like me. She used to fly guard on me, when I was just learning how to use the wings."

They exchanged polite greetings. Then Shalli, giving S'Rella a measuring look, said, "Good luck in the competitions. You'd better not beat Corm, though. I think I'd go mad if he was around the house every day for a year."

Shalli smiled, but S'Rella seemed to take the jest in earnest. "I don't want to hurt anyone," she said, "but someone has to lose. I want to win as much as any flyer."

"Mmm, well, it's not quite the same," Shalli murmured. "But I was only joking, child. You wouldn't want to challenge Corm, really. You wouldn't have a very good chance." She glanced across the room. "Excuse me, please—I see that Corm has found a cushion for me, and now I suppose I must go and sit on it if I'm not to hurt his feelings. I'll talk to you later, Maris. S'Rella, it was nice to meet you."

They watched her moving easily through the crowded room, away from them.

"Would I?" S'Rella asked, her tone troubled.

"Would you *what?*"

"Have a chance against Corm."

Maris looked at her unhappily, not knowing what to say. "He's very good," she managed finally. "He's been flying for almost twenty years now, and he's won prizes in lots of these competitions. No, you're probably not his match. But that's no disgrace, S'Rella."

"Which one is he?" S'Rella said,

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looking around with displeasure.

"Over by Shalli—see—the dark-haired one in black and grey." She tried not to point.

"He's handsome," S'Rella said.

Maris laughed. "Ah, yes. Half the land-bound girls on Amberly were in love with him when he was younger. They were all heartbroken when he and Shalli wed."

That drew a small smile back to S'Rella's face. "On my home island, all the boys used to dream about S'Landra, our flyer. Were you in love with Corm too?"

"Never. I knew him too well."

"MARIS!" The bellow rang from the rafters, attracting attention all over the lodge. Garth was yelling at her from across the room, gesturing her closer.

She grinned. "Come," she said, pulling S'Rella after her through the press, nodding polite hellos at old acquaintances as she went.

Garth crushed her in a formidable hug when she reached him, then he pushed her back to look at her. "You look tired, Maris," he told her. "Flying too much."

"And you," she said, "have been eating too much." She jabbed a finger into his stomach where it hung over his belt. "What's this? Are you and Shalli going to give birth together?"

Garth snorted with laughter. "Ah," he growled, "my sister's fault. She brews her own ale, you know. Got a right little business going. I have to help her out, of course, buy a little now and again."

"You're probably her best customer," Maris said. "When did you grow the beard?"

"Oh, a month ago, two, something like that. I haven't seen you in a half-year, it seems."

Maris nodded. "Dorrel was fretting over you the last time we were at the Eyrie together. Something about a date to get drunk, and you didn't make it."

He frowned. "Ah," he said, "yes, I know all about it. Dorrel goes on endlessly. I was ill, that's all, no great mystery." He turned back to the fire and gave his stew a stir. "There'll be food soon. Hungry? I made this myself, Southern style, with lots of spices and wine."

Maris turned. "You hear that, S'Rella? You'll get some decent food, it sounds like." She ushered the girl forward to face Garth. "S'Rella's a woodwinger, and one of the best. She'll be taking some poor soul's wings this year. S'Rella, this is Garth of Skulny, one of our hosts here and an old friend."

"Not *that* old," Garth protested. He smiled at S'Rella. "Why, you're as beautiful as Maris used to be, before she got thin and tired. Do you fly as well?"

"I try to," S'Rella said.

"Modest, too," he said. "Well, Skulny knows how to treat flyers, even fledglings. Anything you want, you tell me about it. Are you hungry? This will be ready soon. In fact, maybe you can help me with the spices. I'm not really from Southern,

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you know, maybe I didn't get it right." He took her by her hand and drew her closer to the fire, then forced a spoonful of stew at her. "Here, try this, tell me what you think."

As S'Rella tasted, Garth glanced at Maris and pointed. "Look, you're wanted," he said. Dorrel was standing in the doorway, still holding his folded wings, shouting to her above the din of the party. "Go on," Garth said gruffly. "I'll keep S'Rella occupied. I'm the host, after all." He pushed her towards the door.

Maris smiled at him, then began to work her way back across the floor, which had grown even more crowded. Dorrel, after hanging up his wings, met her part way. He threw his arms around her and kissed her, briefly. Maris found herself trembling as she leaned against him.

When they broke apart, there was concern in his eyes. "What's wrong?" he said. "You were shaking." He looked at her hard. "And you look worn out, exhausted."

Maris forced a smile. "Garth said the same thing. No, really, I'm fine."

"No you're not. I know you too well, love." He put his hands on her shoulders, his gentle, familiar hands. "Really. Can't you tell me?"

Maris sighed. She *did* feel tired, she realized suddenly. "I guess I don't know myself," she muttered. "I haven't been sleeping well this past month. Nightmares."

Dorrel put an arm around her and led her through the press of flyers to a wide wooden table against the wall, covered with wines, liquors, and food. "What kind of nightmares?" he asked. He poured them each glasses of rich red wine, and carved out two wedges of a white, crumbly cheese.

"Only one. Falling. I fall through still air, hit the water, and die." She bit off a mouthful of cheese and then washed it down with a gulp of the wine. "Good," she said, smiling.

"Should be," Dorrel replied. "It's from Amberly. But you can't really be worried about this dream, can you? I didn't think you were superstitious."

"No," Maris said, "that's not it at all. I can't explain. It—bothers me. And that's not all." She hesitated.

Dorrel watched her face, waiting.

"This competition," Maris said. "There could be trouble."

"What kind of trouble?"

"Remember when I saw you at Eyrie? I mentioned that one of the students from Airhome had taken ship for Woodwings?"

"Yes," Dorrel said. He sipped at his own wine. "What of it?"

"He's on Skulny now, and he's going to challenge, and it isn't just any student. It's Val."

Dorrel's face went blank. "Val?"

"One-Wing," Maris said quietly.

He frowned. "One-Wing," he repeated. "Well, I understand why you're upset. I would never have expected *him* to try again. Does he expect to be welcomed?"

"No," Maris said. "He knows better. And his opinion of flyers is no better than their opinion of him."

Dorrel shrugged. "Well, it will be

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unpleasant, but it needn't ruin the competition all by itself," he said. "He'll be easy enough to ignore, and I don't imagine we have to worry about him winning again. No one has lost a relative lately."

Maris drew back a little. Dorrel's voice seemed so hard, and the gibe sounded so cruel from his lips—and yet, it was almost identical to what she'd said at the academy on the day Val had arrived. "Dorr," she said, "he's *good*. He's been training for years, it seems, and he's older now. I think he's going to win. He has the skills, I know, I've flown against him."

"You've flown against him?" Dorrel said.

"In practice," Maris said. "At Woodwings. What—"

He drained his wine and set the glass aside. "Maris," he said, his voice low but suddenly strained. "You're not going to tell me you've been helping *him* too. One-Wing?!"

"He was a student, and Sena asked me to work with him," Maris said stubbornly. "I'm not there to play favorites and help only those I like."

Dorrel swore and took her by the arm. "Come outside," he said. "I don't want to talk about this in here, where someone might hear."

It was cool outside the lodge, and the wind coming in off the sea had the tang of salt to it. Along the beach, the poles were up and the lanterns had been lit to welcome night-flying travellers. Maris and Dorrel walked away from the crowded lodge and sat together on the sand. Most of the children had gone now, and they were alone.

"Maybe this is what I feared," Maris said, with a tinge of bitterness in her tone. "I knew you'd balk at that. But I can't make exceptions—*we* can't make exceptions. Can't you understand that? Can't you try to understand?"

"I can try," he said. "I can't promise to succeed. *Why*, Maris? He's no ordinary land-bound, no little woodwinger dreaming of being a flyer. He's One-Wing, half a flyer even when he had his wings. He killed Ari. Have you forgotten that?"

"No," Maris said. "I'm not happy about Val. He's hard to like, and he hates flyers, and there's always the spectre of Ari peering over his shoulder. But I *have* to help him, Dorr. Because of what we did seven years ago. The wings must go those who can use them best, even if they are, well . . . like Val. Vindictive, and angry, and cold."

Dorrel shook his head. "I can't accept that," he said.

"I wish I knew him better," Maris said, "so I could understand what made him the way he is. I think he hated the flyers even before they named him One-Wing." She reached over and took Dorrel by the hand. "He's always accusing, making venomous little jests, when he isn't shielding himself in ice. And sometimes, listening to him, I find myself close to agreeing with him, seeing things through land-bound eyes. According to Val, I'm a One-Wing too,

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even if I pretend that I'm not."

Dorrel looked at her and squeezed her hand tight within his own. "No," he said. "You are a flyer, Maris. Have no fear of that."

"Am I?" she said. "I'm not sure what it means to be a flyer. It's more than having wings, though, or flying well. Val had wings, and he flies well enough, but you yourself said he was only half a flyer. If it means . . . well, accepting everything the way it is, and looking down on the land-bound, and not offering help to the woodwingers for fear they'll hurt a fellow flyer, a *real* flyer . . . if it means things like that, then I don't think I am a flyer. And sometimes I wonder if I'm not beginning to share Val's opinions of those who are."

Dorrel let go her hand but his eyes were still on her. Even in the dark she could see the anguished intensity of his gaze. "Maris," he said softly. "*I'm* a flyer, born to my wings. Val One-Wing surely despises me for it. Do you?"

"Dorr," she said, hurt. "You know I don't. I've always loved and trusted you—you're my best friend, truly. But..."

"But," he echoed.

She could not look at him. "I wasn't proud of you when you refused to come to Woodwings," she said.

The distant sounds of the party and the melancholy wash of the waves against the beach seemed to fill the world. Finally Dorrel spoke.

"My mother was a flyer, and her mother before her, and on back for generations the pair of wings that I bear has been in my family. That means a great deal to me. My child, should I ever father one, will fly, too, someday.

"You weren't born to that tradition, and you've been the dearest per-

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son in the world to me. And you've always proved that you deserved wings at least as much as any flyer's child. It would have been a horrible injustice if you'd been denied them. I'm proud that I could help you.

"I'm proud that I fought with you in council to open the sky, but now you seem to be telling me that we fought for different things. As I understood it, we were fighting for the right of anyone who dreamed hard enough and worked long enough to become a flyer. We weren't out to destroy the great tradition of the flyers, to throw the wings out and let land-bound and would-be flyers alike fight over them like scavenging gulls over a pile of fish.

"What we were trying to do, or so I thought, was to open the sky, to open the Eyrie, to open the ranks of the flyers to anyone who could prove worthy of bearing wings.

"Was I wrong? Were we actually fighting instead to give up everything that makes us special and different? Tell me, Maris. I want to know."

"I don't know anymore," she said. "Seven years ago, I could think of nothing more wonderful than being a flyer. Neither could you. We never dreamed that there were people who might want to wear our wings, but reject everything else that makes up a flyer. We never dreamed of them, but they existed. And we opened the sky for them, too, Dorr. We changed more than we knew. And we can't turn our backs on it. The world has changed, and we have to accept it, and deal with it. We may not like all the results of what we've done, but we can't deny them. Val is one of those results."

Dorrel stood up and brushed the sand from his clothes. "I can't accept that result," he said, his voice more sorrowful than angry. "I've done a lot of things for the love of you, Maris, but I can see the limits. It's true that the world has changed—because of what we've done—but we *don't* have to accept the evil with the good. We don't have to embrace those, like Val One-Wing, who sneer at our traditions and seek to tear us apart. He'll destroy us in the end, Maris—with his selfishness and his hatred. And because you don't understand that, you'll help him. I won't. Do you understand that?"

She nodded without looking up at him.

A minute passed in silence. "Will you come with me, back to the lodge?"

"No," she said. "No, not just now."

"Good night, Maris." Dorrel turned away from her, his boots crunching on the sand until the lodge door opened for him with a burst of party noise, then closed again.

It was quiet and peaceful on the beach. The lanterns, burning atop their poles, moved weakly in the breeze, and she heard their faint clattering and the never-ending sound of the sea rolling in and out, in and out.

Maris had never felt so alone.

TO BE CONTINUED

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carbon dioxide AND climate

THE BURNING QUESTION

There has been a lot of publicity lately for the "scare" that by burning an ever increasing amount of fossil fuel we may produce an irreversible global warming, thanks to the carbon dioxide "greenhouse" effect, melting the polar caps and perhaps turning the Earth into a scorched desert reminiscent of Venus. Even alarmists who don't see the trend going quite that far still seem to assume that any global warming must be detrimental to mankind's continued occupation of this planet, and it is no coincidence that this "problem" with fossil fuels has been seized on by the most ardent supporters of nuclear power as a crucial argument in favor of a massive immediate commitment to nuclear energy rather than fossil fuels.

But this is hardly an unbiased view, and by introducing the issue into the arena of what is still a very acrimonious debate the nuclear lobbyists' main achievement has been to ensure that discussion of the carbon dioxide problem is now clouded by the smokescreen generated by the heat of the nuclear debate. For the Analog audience, of course, reasoned debate rather than hysterical emotion is appropriate, and I am sure that the majority of those reading this article

Are you sure you know what a CO_2 build-up in the atmosphere would do?

JOHN GRIBBIN

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agree that nuclear power in some form —most probably fusion—is a desirable long-term prospect, but that for the immediate future other fuels are necessary as well. An immediate commitment to a nuclear dominated energy economy would almost certainly result in accidents through a too hasty build-up, with a resulting backlash against technology that might take decades to overcome.

So in this article I want to try to penetrate the smokescreen around the debate to look at the links between energy generation, carbon dioxide and climate, assessing how much carbon dioxide really might get into the atmosphere over the next hundred years or so, whether this is enough to pose a threat to civilization as we know it, and by no means least, the extent to which we may be able to remove carbon dioxide from combustion products, storing it somewhere else instead of releasing it to the air.

The CO_2 concentration of the atmosphere has been increasing steadily as long as it has been measured, going back into the 19th century. The average concentration now is about 330 parts per million by volume (ppm) whereas the level in the 1850s was about 268 ppm, and in the late 19th century just under 300 ppm. This increase is definitely the result of man's activities. But it may come as a surprise to learn that so far the biggest cause has been destruction of forests, not burning of coal, oil and gas.

Professor Minze Stuiver, of the University of Washington, has made this surprising discovery by analysis of the carbon isotopes found in the wood of tree rings. This contains carbon obtained in carbon dioxide from the air, and each ring corresponds precisely to one year, storing up a record of how the proportion of carbon isotopes in the air has changed over the years. There are three isotopes involved; stable carbon-12, which dominates, stable but rarer carbon-13, and radioactive carbon-14, produced in the atmosphere by cosmic rays and decaying with a half-life of around 4,000 years. Because of its short half-life, there is no carbon-14 left in the fossil fuels that have been buried for millions of years; wood in living or recently dead trees contains some carbon-14 and some carbon-13, although the lightest and most common isotope, carbon-12, is the dominant constituent. The result is that the balance of isotopes in the air, or in fresh wood of new tree rings, each year results from the balance between burning fossil fuel, forest clearance and photosynthesis. Unravelling the complexities, Professor Stuiver shows that from 1850 to 1950 while 60 Gt (1 Gt = 1 billion tonnes) of carbon reached the atmosphere from burning fossil fuel (a figure easily calculated from energy use data), *twice as much* was produced by forest clearances, reducing the biomass of the planet by 7%. Total input over this hundred year period was three times that from fossil fuel alone, 180 Gt. But the observed increase in atmospheric concentration of CO_2 represents only half this—almost 50%

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has disappeared into natural "sinks."

These are almost entirely oceanic; recent measurements show that 34% of the extra CO_2 going into the air is dissolved in surface ocean waters, and 13% gets advected into the deeper layers. And there seems to be some scope for more to go into these reservoirs. Altogether, the atmosphere today contains about 700 Gt of carbon as carbon dioxide, the living and dead biomass on land contains 1,800 Gt with roughly the same in the surface ocean waters, and the deep ocean contains an estimated 32,000 Gt in inorganic form. The few hundred Gt put into the atmosphere by man's activities so far is literally only a drop in the ocean, and current estimates suggest that the total recoverable quantity of carbon in fuel reserves (including shale) is about 7,000 Gt, still much less than the amount now stored in the deep ocean.

The evidence is that natural processes are not yet being overwhelmed by man's activities, but rather that man is contributing an extra factor to a complex equation, tilting the balance slightly in favor of an atmosphere richer in carbon dioxide. But any massive increase in burning fossil fuels, plus further destruction of the tropical rainforest, may before too long reach a critical stage when the resulting effects on climate make things unpleasant for us. So just how far can we go in increasing carbon dioxide in the atmosphere before things become unpleasant?

The "greenhouse" effect works because carbon dioxide is transparent to incoming solar radiation, but opaque to the infrared radiation which is radiated by the ground (or sea) warmed by the sun. So this heat is trapped near the surface, which it warms slightly. Since the 1950s, when computer modelling of climate became established, there have been many estimates of how much effect a carbon dioxide "greenhouse" would have on surface temperatures. These have differed widely, because of differences in the models and different assumptions built in about the nature of the natural climate system. What is currently regarded as the best estimate has come from Dr. Stephen Schneider, of the National Center for Atmospheric Research, (NCAR), in Boulder, Colorado, who has assessed the relative merits of all the different calculations, explained their differences from one another, and combined them into the rule of thumb guide that a doubling of CO_2 concentration from present levels implies a rise in mean surface temperatures of between 1.5° and 3°C.

Such a warming would not be uniform, however, with the polar regions warming more than the equator, shifting climate zones slightly poleward. This is the confident prediction of climatologists today—twice as much CO_2 shifts climate zones poleward, with an average temperature rise of about 2°C, perhaps a little more. Now, this doesn't seem such a bad thing after all. Instinctively, most of us feel that warmer conditions in temperate latitudes, with the tropics staying

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much as they are, might be rather pleasant, and perhaps also beneficial to agriculture. And certainly a rise of only a couple of degrees isn't going to bring precipitate melting of the polar caps and immediate global flooding.

Can we justify this "gut reaction" that global warming, in moderation, might be rather nice? Yes! Professor Will Kellogg, also of NCAR, has made the analogy with conditions 4,000-8,000 years ago, in the warmest period after the most recent Ice Age, when the Earth really was that little bit warmer. We don't know why—it may even have been related to extra CO_2 from volcanoes, though that seems unlikely—and we can't expect this picture of a warmer Earth to mirror exactly the effects of the greenhouse effect. But it must come pretty close.

We know about conditions back then from a variety of data—changing lake levels, different species of pollen grains left in sediments, showing which plants were growing where, and when, tree rings, the traces left in the rock by receding glaciers, and so on. Kellogg's interpretation of a wealth of such evidence from many published sources produces the rainfall "map" for a warmer Earth shown in Figure 1. Things would indeed be better for agriculture overall, especially in some of the now dry regions of Africa, increasing the ability of the globe to support an increased population while the milder winters ought also to reduce

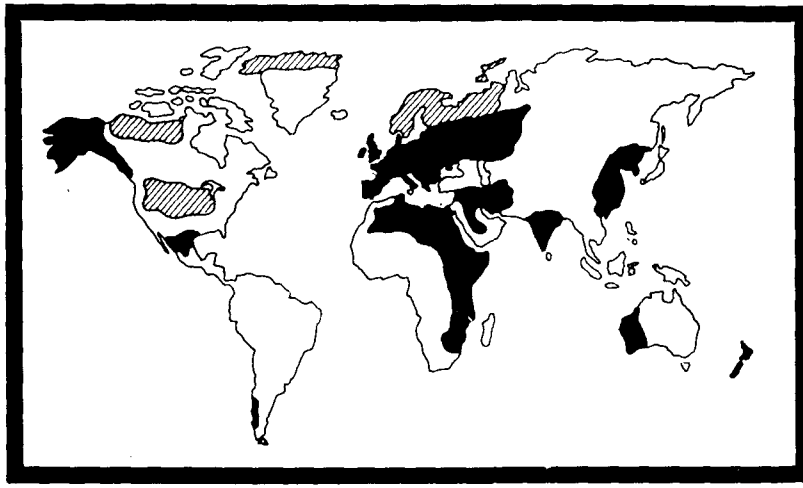

FIGURE 1. *Schematic map of the distribution of rainfall, predominantly during the summer, between 4000 and 8000 years ago when the world was generally several degrees warmer than now. The terms "wetter" and "drier" are relative to the present. Blank areas are not necessarily regions of no rainfall change—information is still far from complete (from W. Kellogg, NCAR)*

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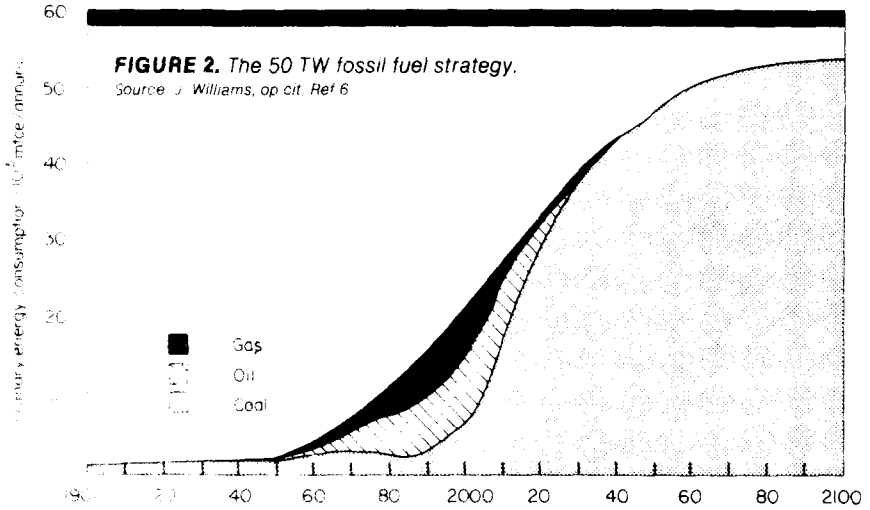

FIGURE 2. *The 50 TW fossil fuel strategy.*
Source: J. Williams, op cit. Ref 6

energy demand! The main fly in the ointment is the likely drying out of a large part of North America, presently the dominant supplier of food grains to the world market. This might cause political problems as the world markets readjust (but on a timescale of several decades), but after all you can't have your cake and eat it, too.

So all the evidence is that a doubling of CO_2 in the atmosphere may be positively beneficial. Provided we can stop the trend there or thereabouts, and avoid the runaway into a scorched Earth situation, we can still use fossil fuel to give us the breathing space while developing ultimately reliable and safe nuclear fusion options. So the *real* carbon dioxide problem centers on letting no more than twice the present concentration build up in the air. Still, for the moment, leaving aside possibilities of *removing* CO_2, we can get a good idea of what this means in terms of energy usage from the many studies of possible future energy demand made by that growing band, the futurologists.

Futurologists argue interminably about different "scenarios" involving, among other things, different levels of global energy demand in the years ahead. Like SF "predictions," these are guides to what *may* be, not what inevitably *will* be. If we don't like a particular scenario, it is up to us to take the necessary political action to ensure that decisions are made to stop that scenario becoming reality. That is what futures forecasting is all about—highlighting dangers and indicating decisions needed to avoid them, not predicting "the" future.

With that in mind, the clear implications of different energy strategies on carbon dioxide ac-

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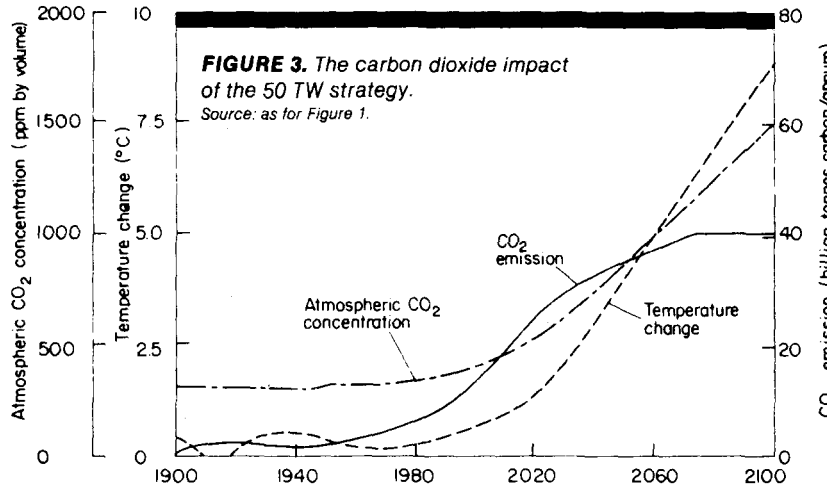

FIGURE 3. *The carbon dioxide impact of the 50 TW strategy.*
Source: as for Figure 1.

cumulation can be seen from a recent study carried out at the International Institute for Applied Systems Analysis, (IIASA), in Laxenburg, Austria. At one extreme, they have calculated the implications of a completely fossil fuel strategy which levels off at about 7 times present world demand, some 50 TW, in the late 21st century (Figure 2). The concentration of CO_2 rises dramatically (Figure 3), eventually reaching 1500 ppm by the year 2100 and raising temperatures by about 9 °C—a genuine doomsday prospect!

Remember, though, that this scenario ignores nuclear and solar power, let alone contributions from wind, waves and tides, altogether. In addition, the maximum demand figures are at the very high end of projections now being discussed, and leave ample scope for more efficient use of energy and reduced demand.

At the other extreme, the same IIASA studies show the implications of a strategy peaking at a more moderate 30 TW and based largely on solar and nuclear power. This produces (Figures 4 and 5) a global surface temperature change of less than 1 °C. Clearly, a sensible and realistic future world lies somewhere between these extremes. Studies at the Science Policy Research Unit, (SPRU), University of Sussex, England, show that one future which could be achieved if the right decisions are made would see energy use per head levelling off at about the level of Sweden in 1970 (rather less than the U.S. in 1970), close to the IIASA 30 TW scenario. However, the SPRU scenario suggests that rather than nuclear and solar power, this demand could be met for the immediate future by a mix of 60% fossil fuel, 10% fission reactors, 20% solar energy, with bits and pieces making up the rest. In this strategy,

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the rise in surface temperature from the CO_2 greenhouse would be very close to 2°C in the second half of the 21st century.

What all this tells us, then, is that sensible energy use need not imply a scorched Earth disaster, and that the options open to us include realistic prospects which keep CO_2 concentration within reasonable limits. We can do better still by using the next 50 years or so to develop effective ways to get rid of carbon dioxide produced by burning fossil fuels in other ways, so that if we then wish to we can burn more coal in the late 21st century.

The problem is now seen not in terms of a Faustian bargain in which fossil fuel spells inevitable doom, but as simply one aspect of pollution among the many now being identified. The most striking comparison is with nuclear power: if we can cope adequately with such unpleasant pollutants as the radioactive wastes from fast breeder reactors, then surely we can cope with a pollutant that is non-toxic, non-radioactive and happens to have been dumped into the air in the past simply because it is a gas!

Dr. Cesare Marchetti, also of IIASA, has looked in detail at ways of treating this CO_2 pollution. There are many processes by which CO_2 can be scrubbed from the waste gases in factory or power station chimneys, headed by dissolving the carbon dioxide in hot potassium carbonate solution or other liquids, from which it can be released at an appropriate time and place by changes in temperature or pressure. The cost of removing 50% of carbon dioxide now released in this way, using *existing* technology, would be no more than $100 per tonne, says Marchetti, including the cost of

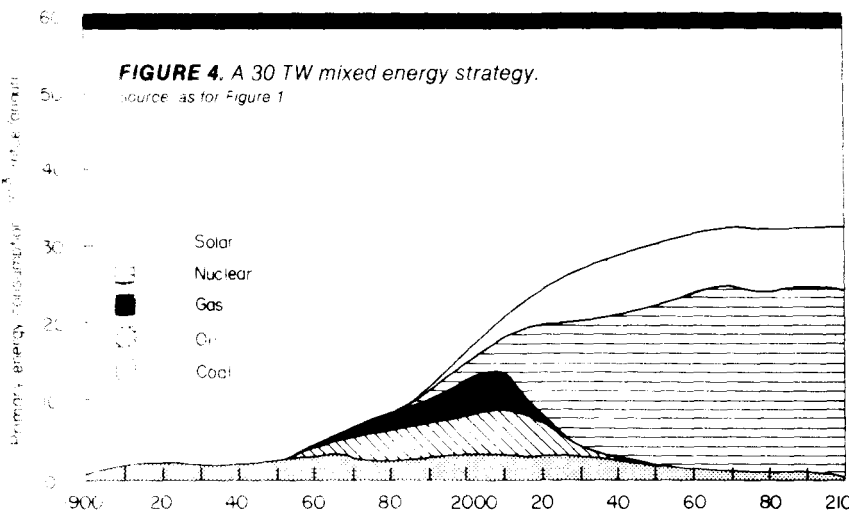

FIGURE 4. *A 30 TW mixed energy strategy.*
Source as for Figure 1

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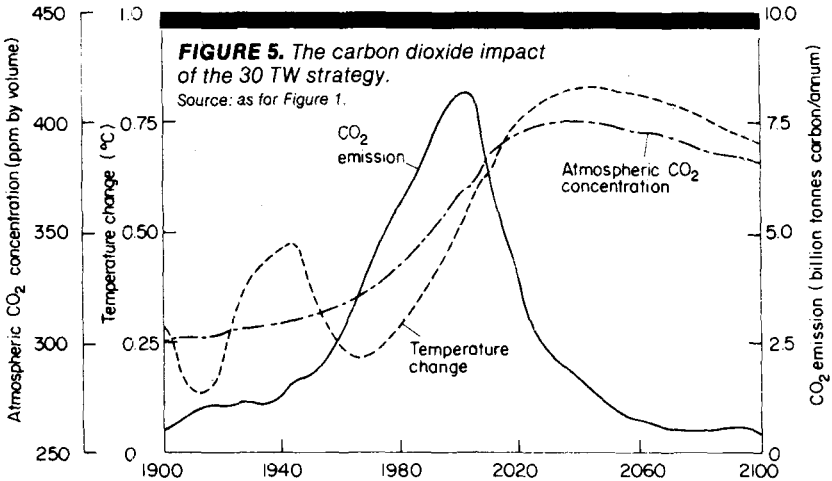

FIGURE 5. *The carbon dioxide impact of the 30 TW strategy.*
Source: as for Figure 1.

disposing of the CO_2 after extraction.

There is still a problem of smaller scale users—automobile exhausts and so on—but here in any case there is pressure for other reasons for a shift away from fossil fuels. There has been widespread discussion about the "hydrogen economy," using hydrogen as the main secondary fuel; in that discussion the source of hydrogen is usually envisaged as being great energy parks where nuclear electricity is used to break sea water up into oxygen and hydrogen. But it could equally well be an energy park where fossil fuel is burnt, with CO_2 carefully scrubbed out, and used to provide energy to make hydrogen, or ammonia, which is then distributed as a fuel like gasoline or natural gas today.

All this is going to cost money—but it is a sad truth that everything we do to protect the environment costs money, and the days of cheap energy are rapidly drawing to a close.

What do we do with the CO_2 when we have collected it? The choice is almost embarrassingly wide. Carbon dioxide is easily compressed into a liquid at 60-70 atmospheres pressure, and can be transported by pipelines like those now used for methane. It could be stored, at least as an interim measure, in the depleted gas and oil fields from which fossil fuels have been extracted, it can be converted into solid compounds which could be put back into mines from which coal has been extracted (not a very practical prospect, but entertainingly neat!), or, the favorite, it can be injected in liquid form directly into the oceans. Marchetti favors this last course, pointing especially to the Strait of Gibraltar region, where very dense Mediterranean water flows out into the Atlantic and sinks into the ocean depths, mixing through the

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oceans on a timescale of at least a thousand years. This site could absorb 10^{10} tonnes of carbon dioxide a year, mixing as a small pollutant into 10^{14} tonnes of water flowing out through the Strait each year, and there are other similar sites around the world.

Ultimately, of course, the problem solves itself. If we can get rid of the CO_2, into the oceans or elsewhere, for the next hundred years there won't be any more problem, because by then we have to develop completely non-fossil fuel options or go under. When the coal begins to run out, solar energy, geothermal power and nuclear fusion must be ready to take its place or our civilization has had it. All we are looking for is a breathing space, and the oceans provide it. In a recent article in *American Scientist,* Dr. C.F. Baes and colleagues state that "the ultimate capacity of the ocean system, including the $CaCO_3$, is far in excess of that required to deal with all the fossil carbon that mankind may wish to use," and other geophysicists agree. The main problem raised by the pessimists has been that of encouraging a sufficiently rapid solution process—and that Marchetti's arguments have now overcome, at least in principle.

We can confidently restate the recent warning in a National Academy of Sciences report that "the primary limiting factor on energy production from fossil fuels . . . may turn out to be the climatic effects of carbon dioxide" to read "the primary limiting factor on energy from fossil fuels . . . may be *man's technological capability to process and store carbon dioxide.*"

This doesn't mean that the situation lacks urgency. The gestatory planning period and lifetime of a major power installation is such that decisions taken today will effect energy use in the early 21st century. We need to learn now to regard carbon dioxide as a pollutant, with immediate legislation along the lines of the legislation on automobile exhaust emissions to ensure its removal from waste gases wherever possible as soon as possible. We need more research into better ways of scrubbing CO_2 from such waste gases, and into ways of storing it after extraction, underground or in the deep oceans. All this will take something very close to the 50 years or so breathing space that we still have in hand.

The psychological barrier of regarding CO_2 in the air as harmful has already been crossed, and for this reason those doomsday scare stories have done a useful job. The next step is legislation using the existing environmental protection machinery, a step which can be taken easily and should be taken urgently. ■

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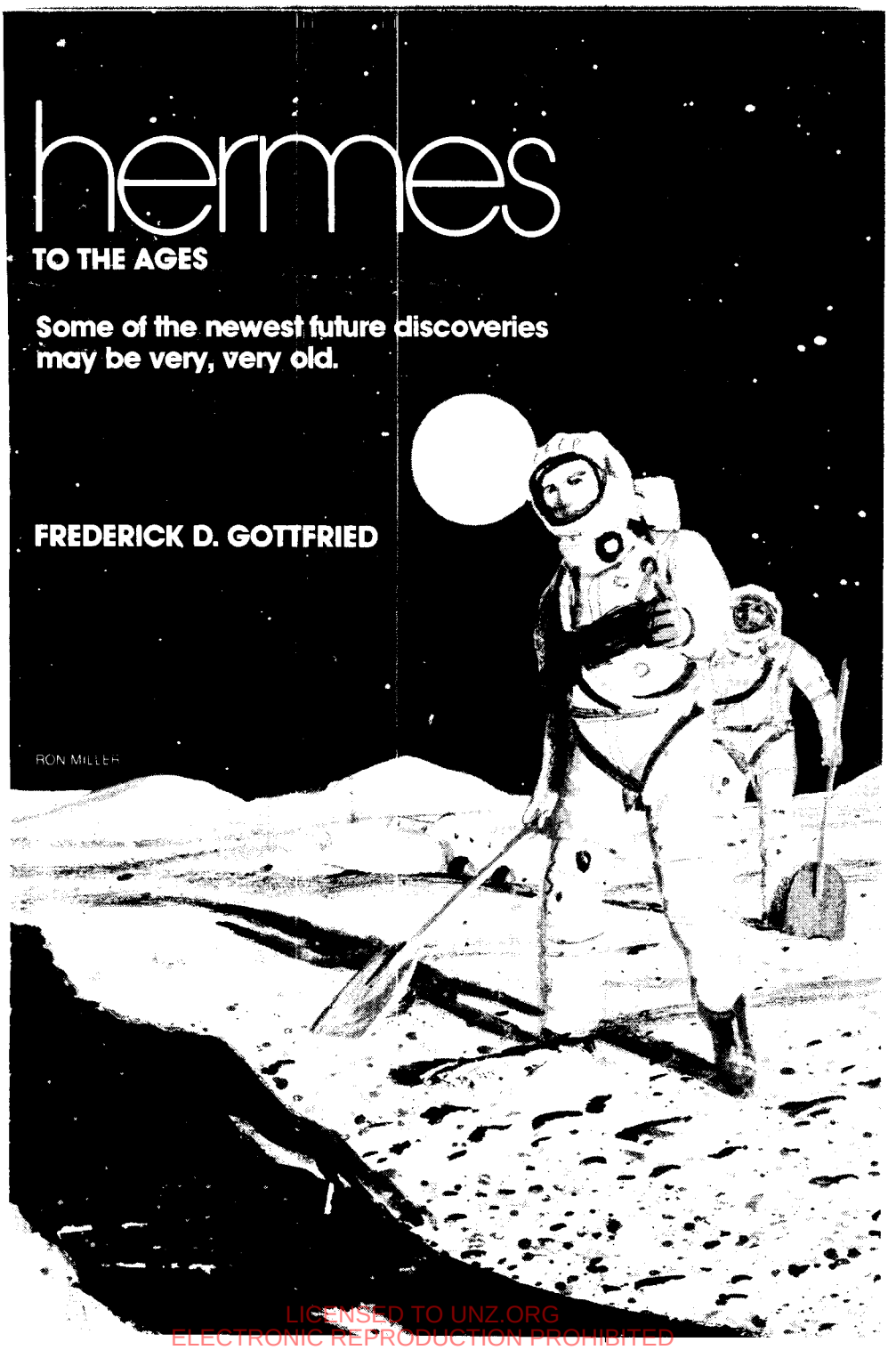
hermes

TO THE AGES

Some of the newest future discoveries may be very, very old.

FREDERICK D. GOTTFRIED



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"What you're suggesting, Professor's, absurd."

"How can you say that, Dr. Tereskevitch, after what your cosmonauts found on the moon?"

The Russian glowered at Professor Lars Hansen. At least it seemed that way to the professor's young associate, Eleanor Mercer. Tereskevitch was commander of *Gagaringrad*, the first permanent Soviet space station. She suspected that he wasn't used to having his work challenged in his domain. Certainly not by Americans.

"Your reputation preceded your flight up. You Americans have a rather unflattering term—cracked pot or crashed pot or something similar. I'm never quite sure with your imprecise English."

Now he was being deliberately rude. Lars, however, merely shrugged.

"Still your government did agree to let this particular crackpot look at your find."

"Why do you keep insisting that anything was brought back other than some unusual rocks?"

"Can I ask the crew members themselves? They're still all up here in isolation—along with whatever it was they dug up."

The look Tereskevitch shot Lars Hansen was as withering as some Ellie used to receive when she had the temerity to ask questions in her freshman classes—from nearly every professor but Lars.

The Russian turnabout was as baffling as it had been unexpected. Everything was supposed to have been arranged. But instead of being welcomed upon their arrival, Lars and Ellie were treated as intruders.

That seemed to confirm the suspicion that *Gagaringrad* was more military than scientific. But another reason the Soviets were reluctant to permit outsiders aboard their station soon suggested itself. *Gagaringrad*, for all its technical innovations, proved crude in many respects. True, they could stand normally thanks to centrifugal force, but they were surrounded by nuts-and-bolts boilerplate. And all the considerable Soviet accomplishment in Earth orbit could not wipe out the fact that they had been beaten to the moon by some twenty years.

"I didn't consent to your coming," growled Tereskevitch. "Why anyone down there thought we needed an *American* paleontologist is more than I can understand."

"Perhaps because my theory finds more credence among your people than my own," said Lars. "*Your* colleagues sent for us, Doctor. They want it confirmed—especially considering the alternative."

Good for you, Lars, thought Ellie.

Tereskevitch pursed his lips. "You would have it that our lunar expedition found a *body* on the moon?"

"Uh-huh. At least, that's what their transmissions indicated—until you clamped down security."

"And you further insist that this—this creature, or whatever you call it, is millions of years old?"

"I'm only guessing, but I have good

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reasons for believing so."

"Sheer fantasy! Millions of years! Do you seriously think, Professor, there'd be even a trace of such a thing after so much time?"

"In the vacuum of space, yes—with all the body fluids evaporated, shielded from radiation, no decay, nothing to disturb its rest."

"But you'd have us believe that this creature is not extraterrestrial? That it's some sort of man?"

"No. Not if it dates back some 65 million years. This marks the transition from the Mesozoic to the Cenozoic era in Earth's geological history. In other words, from the age of reptiles to the age of mammals."

"Professor Hansen, if I understand you correctly—"

"You do. Although the creature your cosmonauts found on the moon may be humanoid in appearance, it is definitely not related to *Homo sapiens*. It's not even mammalian. It is an intelligent *dinosaur*."

Frowning, Tereskevitch turned to the two military men accompanying him and spoke rapidly in Russian. Both their visitors knew that this was not mere translation, particularly when one man obviously disagreed with what Tereskevitch was saying to him.

That was encouraging. Unanimous opinion usually meant rejection. They were used to that, along with a lot of forced politeness. Lars Hansen's scientific credentials were too impressive for rudeness—at least to his face. Besides, Lars was a huge bear of a man who filled the cramped quarters Tereskevitch had picked for their meeting. His patience for lesser mortals was quite incongruous to his commanding presence.

Ellie Mercer, by contrast, had neither his bearing nor patience. She was short and stout—a decided advantage for field work but not in most social situations—and she had little tolerance for fools.

"All this is merely academic," said Tereskevitch to his guests, "since intelligent dinosaurs are a scientific impossibility."

"About as impossible," Ellie put in, "as what you found on the moon?"

Instantly, she was sorry. She'd promised herself to stay out of the discussions. Not to get riled up this time or lash back at their critics. But the smugness of the man was just too much.

Glancing apologetically at Lars, she was surprised how tickled he was by what she'd said.

Tereskevitch decidedly was not. "I regret I wasn't informed in advance of your coming. My people mentioned only your shuttle flight. They should stick to their own business and let me do mine."

Lars grinned sheepishly. "Well, since we *are* here..."

"But you come at a most inopportune time, Professor. We're in the midst of some, ah, delicate matters which require my immediate attention. So I'm afraid you're going to have to go back. At once."

"Dr. Tereskevitch—" Lars pro-

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tested, rising to his full height—and promptly bumped his head against the upper bulkhead.

"Professor," said Tereskevitch. "Are you hurt?" There was genuine concern.

"No, no. It's nothing. *Nothing.* But surely you can't be serious? Leave now? When we just got here?"

The same Soviet official who disagreed with Tereskevitch before also objected. When Tereskevitch grew adamant, the other man became more insistant—and his Russian had the ring of authority to it.

"Well, Professor," said Tereskevitch, smiling without humor, "it seems that some of us would like to hear more about your, ah, rather amazing hypothesis—assuming that it won't take too long."

Visibly relieved, Lars said, "Perhaps if we had an opportunity to examine—"

"There's nothing for you to examine," declared Tereskevitch, "unless I say there is. Now, if you'll please proceed. My time here is extremely limited. Oh, and Professor, do try to restrain your enthusiasm. We'd like to keep these walls intact awhile longer."

Ellie bristled, but Lars didn't mind a bit. She knew that the only thing important to him was his—their—theory. All he had to do was present it and there would be immediate access to the *specimen.*

Ellie said nothing. But she thought she knew better.

For such occasions, Lars had two set speeches. The first, for the scientific community, was impressive in its technical detail. The second, for lay audiences, stressed the more sensational. As much as he professed distaste for such "pandering," it was this latter presentation that Lars found himself delivering far more often.

Ellie had no doubt which one he would give to their Russian hosts.

"Despite his name 'terrible lizard,' the dinosaur comprises a distinct branch of the reptilian family, unrelated to present-day lizards. It was during the 150-million-odd years of the Mesozoic that the dinosaur arose, flourished and then—very mysteriously—died out. Although other forms of reptiles then living—notably crocodiles and turtles—survive down to our own times, no member of the dinosaur branch lived beyond the end of the Mesozoic, approximately 65 million years ago.

"There simply is no adequate explanation for this mass extinction. Every theory so far proposed has its defects. But the most glaring is the assumption that the cause could only have been *natural.*"

At this, even the seemingly disinterested Tereskevitch perked up.

"If you accept the fact that mammals have been the dominant life form on Earth for something less than 65 million years and evolved man in such a relatively short period, why couldn't a similar intelligent creature have emerged during the dinosaur age—a period at least twice as long?"

"A romantic notion," Tereske-

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vitch interrupted, "except that the reptiles are lower on the evolutionary scale."

"Mammals are not so much a higher form of life," Lars replied, "as one more suitably adapted to an environment of rigorous temperature variations. Evolution, Doctor, is hardly a straight-line progression. During the Permian age more than 250 million years ago—a period of climatic extremes comparable to our own—a line of mammallike reptiles evolved with fatty layers under their skin and possibly even fur to keep themselves warm. Their line declined when the climate of the Mesozoic that followed warmed to one more compatible to conventional reptiles.

"And what splendid creatures evolved in the warm and even temperatures of the Mesozoic! The rich variety of specialization of the dinosaur rivals those of present-day mammals!"

Ellie knew what effort it took for the exuberant professor not to wave his arms wildly about in the narrow confines the way he did in class.

"Yes, yes, yes," growled Tereskevitch impatiently. "But still just brutes, for all of that. Nothing comparable to man."

Lars smiled. "Let me tell you something about revered *Homo sapiens*. He did not become what he is today by virtue of his brain alone. No, he required four additional physical attributes: walking upright to free the forelimbs for uses other than locomotion, hands that could grasp and hold tools, depth perception to utilize those tools, and a voicebox for speech and communication. Now this may surprise you, but in all evolution there's only one other class of creatures besides primates that possesses similar characteristics—the saurischian carnivorous dinosaur.

"Take one example I'm sure you're familiar with—the fearsome *Tyrannosaurus rex*. He walked upright. Had shortened forelimbs, very similar to the human arm, used to grasp and hold prey. His eye sockets were set more forward in his skull than to the side, giving him binocular vision. Of course, we don't know his internal physiology, since all we possess are fossilized skeletons. But he could have had some structure capable of emitting distinctive sounds. It needn't have been like our vocal cords. The modern parrot imitates the human voice quite neatly using the syrinx near the juncture of the trachea leading into its lungs."

"Professor, you have a knack for skipping over the most important points," said Tereskevitch. "You should have been a politician. But I would still like to know about the brain. If I remember rightly, all the dinosaurs were like the one with a brain no bigger than a walnut—the one with the plates on its back and the spiked tail. I forget its name—"

"*Stegosaurus,*" supplied Lars. "Yes, I agree with you that there were many dinosaurs like that. But we're not talking about the plant-eaters—the sheep and cattle of their day. We must look instead to the car-

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nivores—and not the hulking monsters like *Tyrannosaurus* that didn't need intelligence to survive. But dinosaurs, like mammals, came in all sizes. It's the smaller, more agile ones that prove the most promising."

"Such as what?"

"Such as *Deinonychus,* with a nervous system so sophisticated that it had the coordination to stand on one leg while attacking its prey with the other. And *Dromaeosaurus,* with its greatly enlarged braincase. And *Stenonychosaurus,* which had a large brain, binocular vision, and opposable fingers. The fossil record supports the existence of these. There are more recent finds"—Lars glanced knowingly at Ellie—"which are still being bitterly disputed.

"Don't forget that man developed from the smaller, more intelligent primates. Just as we are not descended from the bison, Dr. Tereskevitch, don't look to *Stegosaurus* and his ilk for proof that intelligence could not have existed contemporaneously."

"What proof do you offer that it did?" asked the Russian.

Ellie caught Lars' questioning glance. She shook her head. Not yet. Tereskevitch still doubted too much.

"It, uh, would be very surprising if I had any at all," Lars hedged. "Paleontology depends on fossils. On land, the process which creates them is extremely rare. So rare, in fact, that out of the millions of individual members of some species, we possess only a couple of complete skeletons. Less than one one-hundredth of the total species that lived in past eons—that's all we estimate that we know of."

Ellie's judgment was borne out by Tereskevitch's obvious incredulity.

"An example," said Lars, "out of my field, perhaps, but true nonetheless. All we know about certain types of ancient man comes from what, four or five specimens? That's because the number of individuals living at one time was always small. And the time span involved—only one to two million years compared to the tens of millions for most species of dinosaur—if there's any evolutionary parallel, the creature your cosmonauts found may not have existed long enough to leave a permanent geological record!"

"Interesting, your example of prehistoric man," said Tereskevitch, "only there's just one problem: today man numbers in the billions. Our presence at this stage would hardly go unnoticed by any curious future anthropologists."

"Maybe our intelligent dinosaurs were never very numerous. Remember how comparatively small human population was until recent centuries."

"What about their civilization itself? Their buildings, artifacts?"

"Gone. Vanished. All traces obliterated."

"That, I cannot accept."

"There are modern parallels. A hundred years ago, what did we know of Sumeria outside the Bible? Troy itself was just a legend. The Maya of

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Mexico—we knew nothing of abandoned cities *miles* long."

"But once discovered," said Tereskevitch, "there was a wealth of archeological finds."

"And much more that had been destroyed forever by the natural processes of nature. Doctor, we're not talking about hundreds or thousands of years. Nor just a million. Can you conceive of the result of *tens* of millions of years of erosion, decay, seas flooding dry land, mountains thrust up and worn down, the very continents torn apart and reshaped?"

"Surely something would remain," Tereskevitch said. "Tools of some kind—even if only like those found with primitive man?"

"Tools are barely distinguishable from the rocks in which they're found. It takes a trained eye to recognize them for what they are—something extremely unlikely if one has no reason to be looking for them."

There was a definite change in Tereskevitch. No longer was he openly skeptical. He was carefully considering everything Lars said.

"Even if I concede the possibility of such creatures—not to mention their entire civilization—escaping detection, one thing would not: their effect on the environment. Any civilization capable of putting one of its members on the moon—as you suggest—would require extensive use of coal or petroleum. Obviously, our present supplies have not been depleted by

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anyone other than ourselves."

Ellie might have pointed out that the era they were discussing was the source for today's oil. Coal, however, was formed in the Carboniferous, long before, so the point was probably well-taken.

But Lars didn't bother. "Why assume," he asked instead, "that they relied on fossil fuels, the way we've so foolishly done?"

"Now we're in *my* expertise, and I tell you that fire is essential to technology. Without it, man would still be living in caves."

"Ah, but what drove man into those caves in the first place? The Ice Age. Whatever else, fire became essential for survival against the cold. But there were no ice ages in the Mesozoic. With a warm and uniform climate, there wouldn't have been the overriding need for intelligent creatures to become dependent—fixated actually—upon fire."

"Maybe not in the primitive stages. But how could they possibly develop industry without fire to forge their metals?" Tereskevitch countered.

"I don't know," Lars admitted. "A substitute for the metals we know? A different source of power? You tell me. That's your field. Only I can't help wondering if you're letting your expertise blind you to different possibilities. Who says the way *we* did it is the only way? Cities, metals—all those things you find so essential—they've been around for only the last 5,000 years. Man became the master of Earth long before the rise of modern civilization. And there are cultures today—the Australian aborigines, for one—said to have societies more complex than our own, all without the trappings of so-called modern man. Could *that* be the model for our intelligent dinosaurs—rather than your country or mine?"

"Perhaps," said the Russian, "if we were talking about a body found in Australia. Maybe you can enlighten me, sir, on how an aborigine—without metals or other technological innovations—made it to the moon?"

"You mean, how could he do it the way we did it?"

"How else?"

"How else, indeed? Wouldn't it be wonderful to search for the answer here on Earth—rather than in some far-off and unknown solar system?"

Tereskevitch obviously agreed. "All this is very intriguing. A pity you have no evidence to support your theory."

"I never said that."

"What?"

"I've only tried to give you an idea how difficult it would be to find such evidence. Shall I go on, Doctor?"

Before Tereskevitch could say anything, a loudspeaker blared out his name.

The Russian words were indecipherable, but there was no mistaking the urgent tone.

"Excuse, please, Professor," Tereskevitch said quietly. "A brief moment. We'll be back as soon as possible."

As soon as the three had shut the

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natch they passed through, Lars cried out happily. "By God, we've got them hooked, Ellie!"

Ellie wasn't so sure. Interested, yes. But so far it had all been one-sided. They'd listened to what Lars told them but promised nothing in return.

Poor Lars. So trusting. Never could understand that people could be mean or jealous because that's the way they are. Or that envy could be just as important in the rejection of their theory as honest skepticism.

"You ought to be the one to tell them about *Herman,*" said Lars.

"Oh no, Lars. I—I shouldn't say anything more. I almost blew it for us before."

"No, really. You've got to understand Tereskevitch. He'd have reacted the same no matter what either of us said. I was warned about him: part of the team that orbited Gagarin. Worked as hard as anyone to beat us to the moon. Really believed they could have if the politicians and bureaucrats had stayed out of it. Still thinks they should have. But he's a scientist. A damned good one. That's the side of him we've got to interest."

Lars grinned wickedly. "Besides, if you hadn't asked him that, I would have."

Still Ellie hesitated.

"After all, you discovered him," Lars pointed out. "And I can't help feeling I've monopolized the conversation long enough."

Ellie recalled every detail on the sun baked plains of western Australia five years before. That, the skeptics could never take from her—the magical moment of discovery.

She had been a mere undergraduate, chosen by her favorite professor to accompany his fossil-hunting expedition during summer vacation (winter, fortunately, in the searing climes of the outback). What she lacked in confidence, she more than made up for in hard work. That was what originally brought her to Lars' attention and what qualified her for the expedition. It was also what led to her discovery.

It had been Ellie who put in the extra few minutes digging at dusk that uncovered the precious bones.

The new find had been unclassified. Its skeleton lay in a fetal position, with the shortened forelegs drawn up to the skull. Compared to the typical dinosaur death pose of head arched back due to post-mortem tightening of the neck ligaments, this posture appeared extremely manlike.

Good-naturedly, Lars—then still "Professor Hansen"—suggested designating the new creature *Homosaurus mercer.*

Ellie preferred her own nickname for it: "Herman."

The more important discovery came the next morning. Ellie had awakened before dawn, long before any of the others, to be with *her* find. She had come a long way from a nondescript small town and the misery of being an unpopular and overweight girl in high school, who, to make matters worse, was smarter than any of her teachers. Now none of that mat-

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tered. How could anything human beings concerned themselves with compare to the 65 million years Herman had lain undisturbed?

As first light crept over the eastern hills, Ellie knelt in awe and pride before the partially exposed bones. Almost the entire left side of the specimen lay uncovered. As she watched, the shadows lifted in the morning sunlight from its small tail bones, then from the larger bones of the hips.

Frowning, Ellie looked more closely at one of the lower vertebrae. She bent over, whisking her tiny brush across the fossilized bone.

With a yelp, she leaped to her feet.

"Professor Hansen, Professor Hansen!"

Frantically, she raced back to camp.

Only the professor could confirm the impossible.

The Russians were all apologies when they returned. Perhaps Lars' intuition was correct. Ellie sensed renewed impatience, but it would have been much more difficult for them to be rude to her.

Any resentment she felt vanished as she described what it had been that so astonished the expedition, changing the course of Lars' and her lives. "The long rays of the morning sun made it stand out," she concluded. "An enormous swelling in the lower vertebrae. Even I—the greenest of all—could tell that the tiny lump that lodged there was not a bone fragment or anything similar. Most of it had broken off, but there was no mistaking what was still imbedded—the tip of a *spear* or *arrow.*"

Ellie paused. Usually at this point came the denunciations. She was especially sensitive about this since she had been alone for some period of time with the specimen and the implication was clear. One so-called expert even went so far as to accuse her of fabricating the point and sticking it into Herman herself.

Instead, Tereskevitch thoughtfully chewed his lip. "What sort of collaborative evidence did you find?"

"None," she had to say, "at least not at this site."

"But once the notion took hold that there might have been intelligent creatures predating man," said Lars, "we began to accumulate from all over the world items no one has been able to explain. This, for instance."

From his pocket, Lars removed a vial containing what appeared to be a piece of blackened egg shell. "This dinosaur egg came from Mongolia. Your people were quite helpful in supplying information about it. Apparently, this sat on the shelf unrecognized for years. Certainly, we in the West had no idea of its existence. Look at the markings on the outer surface."

One by one each of the Soviet officials viewed the object carefully.

"You are looking at what may be the egg of one of *their* young."

Tereskevitch looked up sharply from his examination.

Lars said, "Our theoretical

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creatures, being reptilian, probably laid eggs rather than bear their young alive. This is no reason to believe they didn't lavish the same care and affection upon their children as we do. And I quite imagine that they would look upon an unprotected fetus carried for months in the womb with equal astonishment, if not outright disgust."

"These markings," Tereskevitch muttered, "could be natural."

"One straight line in nature," said Lars, "maybe even two could be explained. But six—interwoven to fit what could be a geometric pattern? If these eggs remained for any extended period unhatched, intelligent creatures might wish to designate and distinguish them. Perhaps what we're looking at represents the future child's name."

"You do have a tendency to humanize them, Professor. Forgive me if I say that I find this quite—quite disconcerting. Did you find any specimens of these creatures that had, ah, hatched?"

"No. And this leads to the most startling discovery of all."

Before Lars could go on, the third military man—the one who had not protested earlier when Tereskevitch wanted to end the discussion—whispered something to Tereskevitch. Irritated, Tereskevitch looked at his watch, then shook his head no.

"Forgive the interruption, Professor. Please continue."

"Generally reptile eggs are porous, permitting transfer of air from outside while retaining sufficient resilience to protect the developing individual inside. Detailed examination of the microstructure shows this particular eggshell lacks such properties. Whatever was inside could not have survived."

"So? A piece from a single egg?"

"Not just one egg," Ellie said. "Every single egg your people claim was found with this one was similarly affected."

"And all date from the same period," Lars added. "The late Cretaceous, the last period in the Mesozoic—the very end of the age of dinosaurs."

Tereskevitch frowned. "What are you trying to say?"

"There are certain things that could do this," Lars said. "Disease, for one. Some sort of chemical poison. Or radioactivity. Short, but intense. Such as in a major war."

"You—how do you say it?—jump to conclusions. Very unscientific, Professor."

"They had the ability to use weapons. That's the significance of Ellie's find. And we come back to the initial question: what single catastrophic event could have wiped out an entire line of creatures such as the dinosaurs? Do we ignore a possibility all too real in our own times?"

"Still you have no proof that these hypothetical creatures of yours possessed anywhere near a technology capable of such a thing."

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"That's what I thought too," said Lars, "until your discovery on the moon. If the creature brought back turns out to be one of them, that would be such proof."

"How could you show any connection whatsoever?"

"If the skull has certain openings behind the eyes characteristic of the dinosaur branch of reptiles, we would know for sure."

Again the third Soviet officer touched Tereskevitch on the shoulder. This time Tereskevitch nodded his head.

The officer who had supported them before did nothing.

"What then, Professor?"

"We could tell the world."

"Why should we do that?;' Tereskevitch's voice hardened.

"The knowledge it would bring—"

"There's no need to tell anyone at this time. *If* things were as you say, it could wait until confirmed by *our own* scientists."

Never had Ellie seen such dismay on Lars' face. "But this discovery belongs to all humanity."

"Assuming there was such a find," said Tereskevitch, "it would still be within the province of *Soviet* scientists to release it. Don't you agree?"

Ellie knew it. It always amounted to the same thing. What made Lars think it would have been any different with Tereskevitch?

"I see," said Lars, the defeat so heavy in his voice that Ellie wanted to cry in anger. "But—how soon will you make the announcement? That much at least you'll tell us?"

"It has not been decided," said Tereskevitch, "when, *if at all.*"

"What do you mean," exclaimed Lars, " 'if at all'?"

"I mean just that. How can there be an announcement if there is nothing to announce?"

"How can you say that? What have we been discussing all this time?"

"Your theory, Professor. And we've found it quite instructive. However, this interview now must end."

"Wait," Lars pleaded. "Let me prove it to you. Just a quick examination—"

"Examination of what? No body was found on the moon. If you must know, our cosmonauts did find some strange rocks. But, unfortunately, when they were brought on board and exposed to the air, *they crumbled into dust and are no more.*"

The Soviet scientist smiled patronizingly. "So you may go back to Earth, secure in the knowledge that there's nothing for you—or any western scientist—to examine."

The shuttle orbiter backed off from *Gagaringrad.* Lars and Ellie sat in the two rear couches on the flight deck, still dressed in the pressure suits, minus helmets, required for the short EVA to and from the space station. It was much easier just to keep them on the short time it would take to return to Earth—particularly considering the effort it took to get the bulky professor into his in the first place.

They stared dejectedly at the slowly rotating dumbbell that seemed to

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shrink in the blackness as distance increased between them.

"I feel so—so used," said Ellie angrily. "We gave them everything. And then to tell us that they—they destroyed *him*—"

"Don't believe that for a moment," muttered Lars. "Someone else, maybe. Mistakes happen. Specimens get damaged or destroyed. But not Tereskevitch. He's too careful for that. No, he's got *Herman II* over there. Safe. But he intends to suppress any knowledge of his existence. That's what's so appalling."

It would be several minutes before they attained the point in orbit for firing their re-entry rockets. Capt. Bradley, command pilot of the orbiter, turned from his controls and asked, " 'Herman II,' sir?"

Despite everything, Lars had to smile. "Just our name for the Russian find. 'Herman I' was the fossil in Australia—the one Ellie thinks was killed in some form of intertribal warfare."

"Oh, I know you think he was just some animal being hunted," she retorted. "A more primitive stage in their evolution. But why couldn't the intelligent ones have retained their tails? They didn't have to be *exactly* like exalted *Homo sapiens.*".

Ellie thought she detected the familiar twinkle in Lars' eye. Often he'd bring up points like this, delighting in drawing out the not-so-scientific basis for her insistence. He wanted her to learn to laugh more at things that bothered her. Was he doing that now—for both of them?

"Mind telling me one thing?" Bradley asked. "Just exactly what was it you think killed off the dinosaurs?"

Ellie cringed. That part of their theory Lars wished had never been raised. Sensationalism at its worse. Probably more than anything else the cause of most of the ridicule they'd received. She'd have ignored the question, told the captain to just go back to his controls, get them back to Earth as fast as possible.

But then, when could Lars *ever* give up an opportunity to lecture?

"Had to be a biological war," Lars told Bradley.

"You seem so positive," Bradley said.

Bradley was everything Ellie expected a shuttle pilot to be: stalwart, self-assured, moderately intelligent. He could have been her high school quarterback. She hadn't cared much for him either.

"Process of elimination," said Lars, "*if* you assume intelligent beings had anything to do with it at all. Nuclear weapons? No, they'd have destroyed indiscriminately all forms of life. Yet we find a continuity among the plants and animals other than dinosaurs. Chemical agents? Possibly. Except that the devastation was planetwide, affecting reptilian life in the seas as well as on land. The effect must have been multigenerational. This implies the ability to reproduce. So we come down to some type of living agent—a highly selective but worldwide plague."

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"You make them sound a lot like us," Bradley said.

"I suppose so. A natural tendency for people who look upon the past as alive. You ought to see the pets Ellie's made of some of our specimens."

"Lots better," said Ellie, "than some of the things alive today."

"There is one way I hope they were like us," Lars said. "I keep wondering what we'd do if we'd survived the initial outbreak. Try to leave some sort of record—something to warn of the tragedy that befell us for whatever the future might bring. And someday we'll come across that—whatever their Rosetta Stone might be."

Bradley shook his head. "You've got me again, Professor."

Patiently, Lars explained, "In 1799 a piece of black basalt was found near the mouth of the Nile which bore inscriptions in an ancient Greek and Egyptian. Before its discovery, no one could interpret the hieroglyphics of ancient Egypt. The Rosetta Stone became literally the key to unlocking the secrets of a hitherto unknown world."

"And you think your intelligent dinosaurs left one of those?"

"I thought we had its equivalent over there." Lars gestured toward *Gagaringrad,* and Ellie saw the sigh—a small gesture that someone who did not know him well would have missed. "Well, whatever comes of that, Ellie and I will spend the rest of our lives looking for other traces that must be somewhere. Right, Ellie?"

So Lars had reconciled himself to the loss. And probably lost none of his faith in human nature. Ellie knew what he'd say about the way the Russians treated them: "They had their reasons"—as if that was enough. Damn it, why did he always have to be so generous? Hadn't he ever been kicked in the teeth? Big as he was, did he always have to be so far removed from ordinary human cussedness?

Difficult as it was, Ellie managed a fleeting smile.

"You know," Bradley went on in his obtuse fashion, "what you suggest sounds inefficient as hell. I mean, you'd think your dinosaurs would've tried something better than stone inscriptions to pass on their secrets."

"Well, I didn't mean that literally," Lars said.

"Yeah. Sure'd been interesting if they had some of the techniques NASA's been experimenting with."

"Such as?"

"Oh, things to cut down long duration flight. Takes centuries to go even to the nearest stars with what we've got now. They're working with test animals. Freezing them. Dehydrating them. Trying to find some practical form of *suspended animation.*"

"Aii—yeeeeeeeee!" Ellie's shriek cut through the cabin.

Lars was a half-step behind her. "The lifeless, eternal moon! No need to worry about the world changing about you! A landscape that's been the same for billions of years and would be for billions more!"

"Until intelligent life re-establishes itself on Earth," cried Ellie, "and

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finally develops the capability to get back to the moon and—and—and finds what's been left up there for them to find!"

"Oh, how close you were in naming him 'Herman'! Herman—*Hermes*—Hermes, the messenger of the gods!"

"What—What's got into you two?" said Bradley.

"Don't you see, man?" Lars said. "*That's* why they wouldn't let us see him. Not that they didn't find anything. Or destroyed what they found. No, they found more than they realized. All that activity, the impatience to be rid of us. They found out he's alive. And they didn't want any Americans around while they *revived* him!"

"The bastards!" Ellie exploded. "Leading us on like that! Laughing behind our backs! All the time knowing—"

"Wait, Ellie. The one thing we didn't have a chance to tell them—our theory about the plague. What if the specimen's *still* contagious?"

Lars told Bradley: "Contact the station! Immediately!"

"Professor, you can't be serious. A plague? Why, the thing over there's what, a reptile? You don't get disease from animals."

"Oh, you don't? Ever heard of anthrax, Captain? Bovine or poultry tuberculosis? Salmonella, that you catch from turtles? Or maybe you've forgotten that the carriers of the bubonic plague that wiped out a third of Europe were rats?"

"You've made your point," said Bradley. "But surely they've taken precautions. Decontamination procedures of some kind?"

"You mean like we did after the Apollo splashdowns?" said Ellie. "Scrubbing the capsule down by hand while it bobbed up and down in the middle of the most fertile natural medium in the whole damned world!"

"Captain, we don't know what the hell they're doing over there," Lars said. "Would you please just send a message?"

"All right," said the haggard shuttle commander.

Orbiter and space station continued in their joint orbit hundreds of meters apart. But the radio from *Gagaringrad* remained silent.

"They refuse to even acknowledge my signal," said Bradley.

"They must be going ahead with their experiment," Lars said.

"It is rather inhospitable," said Bradley grimly. "They can't know it's not an emergency over here."

"We can't wait any longer," Lars said. "Anybody got any ideas?"

Ellie did: "Ram them!"

"What!" Bradley protested.

"Well, that'd sure slow down whatever they're doing," she said.

"Captain, somebody's got to get on board before they have a chance to get into it. What about taking this ship close enough to let me try to sneak inside without being seen?"

"Professor, you're both talking crazy. Much as I wouldn't mind ramming this ship down those bastards'

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throats, that's obviously out of the question. In fact, *any* EVA's much too dangerous."

"We did it before," Lars said.

"Sure. On a line, with me guiding you at this end and a big smiling Russian on their side. Don't think there'll be too many of them smiling now."

Ellie watched Lars stare at the station so tantalizingly close. He was calculating the risks, and she thought she'd better start doing the same thing. One way or another, Lars was going across.

"Hell, let the Russians kill themselves," said Bradley, "if that's what they insist on doing."

"Don't you see the real danger?" Lars said. "Suppose the disease organism can't be controlled? We don't know how it's spread or whether it can be isolated to *Gagaringrad*—especially if the Russians refuse to believe us about the cause. And if they somehow manage to spread it to Earth..."

"Damn, you make sense even when you don't make sense," Bradley said. "Only *I'll* be the one to make the EVA. My copilot can take the ship in close. It'll be a bit tricky for one man, but I think—"

"But I'm already dressed for it," said Lars. "Besides, what would you tell the Russians once you got over? At least I can make a convincing case. You still only half believe it yourself."

"And you're the last person who should go, Professor. You don't know how to handle yourself in weightless space."

"Captain, as a paleontologist, I've climbed some places in my field work you wouldn't believe possible."

"It's a different ball game out here. You haven't the training. You'll just end up getting yourself killed."

"I have to go."

"We'll both go," Ellie declared.

Lars started to protest.

"Oh don't be so impossibly noble," she told him. "You couldn't possibly make it by yourself—even with the fate of all mankind riding on those big broad shoulders."

That settled the matter.

Quickly Bradley helped Lars and Ellie put their helmets back on, and handed them safety lines. He gave what instructions he could, ending with an impassioned, "Most important of all, don't lose your heads. Especially you, Professor."

The two novices entered the tiny airlock to the rear of the flight deck. Lars managed to float down to the outer door without difficulty. But when Bradley fired the ship's main engines for a short burst, he banged against Ellie's space-suited figure.

Ellie knew this was insanity. Even if they did get across, why should the Russians listen to them? Didn't Lars learn anything about Tereskevitch before?

Still, they had to do something. And maybe this time they would gain access to the specimen.

They heard Bradley's voice through their suit radios: "Mayday! Mayday! This is Shuttle *Constitution*. We have a misfiring rocket."

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"*Constitution,*" came an alarmed Russian voice, "you are on a collision course. Turn or reverse power."

"Negative," said Bradley. "No other system functioning. Wait, I have powered down the malfunctioning engine."

Awkwardly with her gloved hands, Ellie had followed the instructions of Bradley in fashioning a wide noose in her safety line. It hung stiffly in the weightless space just beyond the open hatch. The idea was to somehow catch it on some projection from the space station.

Ellie was a lousy swimmer, but she could float in water indefinitely. She'd already decided that they would never make it across if she tried to "swim." But if she let the safety line do the work while she simply drifted with the motion of her body, there was a chance.

The hardest thing would be to ignore what was happening to Lars.

"Stand by," said Bradley to Lars and Ellie only. "I'm going to kill all forward velocity."

Gagaringrad's spin in space to provide artificial gravity was slow. Bradley had aimed toward the almost stable central hub to minimize the possibility of collision. "Get ready," he radioed, and Lars and Ellie braced themselves as best they could against the seal of the opened hatch.

The station's dull-grey hull filled the blackness ahead. Concentrating on the row of external hatches with their various extensions, Ellie grasped the line tightly. She couldn't throw it. She had to transfer to it the motion she would gain by kicking free from the orbiter, keep its loop wide, get close enough to the station to trail it across the hull.

She didn't want to think about the possibility that the Soviets' inhospitality included locked doors. Extremely unlikely, considering the intended use of the hatches, but still ...

Through their suit radio, Ellie heard Lars mutter hopefully, "Maybe the near-miss itself will be enough."

Oh, Christ, Lars, she said in silent exasperation. *Do you want to go back now?*

No, she felt him crowding close to the hatchway. Come what may, he was going.

All right. Only please, if you don't do anything else, just stay out of my way until I can get us across.

The entire fabric of the orbiter shuddered as all forward reaction control engines ignited.

The deceptive gentleness of their approach must have deceived Lars. Unprepared, he found himself propelled out the open hatch by his own immense inertia.

Ellie couldn't stop him without being thrown out herself.

Ignoring his tumbling figure, Ellie kicked out as hard as she dared directly toward the slowly turning space station. So far so good. She remembered everything Bradley'd told her about keeping herself in line with her center of gravity. The noose was still wide, extended ahead of her toward the hull of *Gagaringrad.*

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Damn, it was exhausting moving within her spacesuit! She began to puff. At least she was in good shape from her field work. And she didn't have to fight the direction she was coasting.

Keep floating, Ellie! she told herself. *Don't swim.*

Abruptly, her own motion stopped.

Even as she oriented herself, the snagged line brought her down to *Gagaringrad's* hull. And since her kicking had given her greater exit velocity, she had passed Lars on the way over. His slowly turning spacesuit, with its tangle of arms and legs, was coming her way.

Even the rotation of *Gagaringrad* was cooperating, bringing her toward him rather than away.

Ellie was not about to tempt luck any further. Before kicking off again, she re-secured her line around the nearest support she could find.

As it was, she almost missed Lars as he drifted past in his desperate efforts to stop his tumbling, huffing and wheezing from the effort.

Her gloved hand just barely caught a thrashing foot and tugged.

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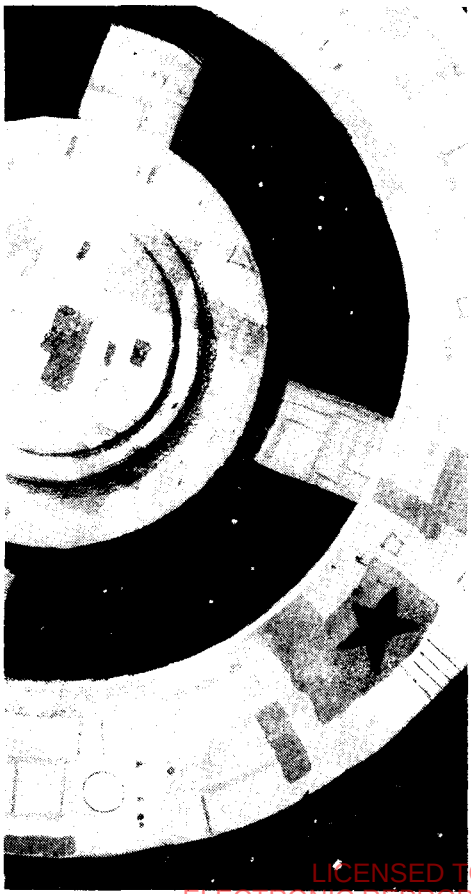
"Lars, you big oaf, *relax*! Stop fighting me! You're too blasted strong! I'll pull us in. Just don't do anything!"

Like a caught fish, Lars let Ellie reel them both toward the hatch to which she had attached her line.

Within moments they were safely inside. Lars placed one gigantic gloved hand on Ellie's shoulder and, with a quick squeeze, said all that had to be said between them.

"Where now?" Ellie asked as they both caught their breath.

"Good question. Their labs must be located in the end opposite from where we met before. But damned if I can tell one from the other."



"Lars!"

Sounds of people approaching emanated from the central hub, which, because of the slight pull of centrifugal force at their present location, was "above" them.

"They just made up our minds," said Lars. " 'Down' we go."

The two Americans pushed themselves along a ladder, passing through a series of compartments with hatches that sealed each from the other. The farther down the passageway they traveled, the greater became their apparent weight, until they had to use the rungs of the ladder.

"Are we going the right way?" Ellie wondered.

"Fifty-fifty. But we haven't met anyone this way yet. Figures they wouldn't allow many people nearby when they started their experiment. They like to keep secrets, even from themselves."

The bottom compartment was much wider than those above. They had arrived at one of the two large personnel spheres located at each end of *Gagaringrad*.

Waiting for them were Tereskevitch and the same two as before.

"So, Professor Hansen, I suppose I should ask what the meaning of all this is."

The Russian scientist had his anger somewhat under control. The same could not be said for his two scowling comrades.

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Ellie was first to remove her helmet. "You've got to stop what you're doing."

"Indeed? And just what, Miss Mercer, do you think that is?"

"You're going to revive Herm—the specimen. You can't do that."

"You *are* mad. I was just saying it before. But this. Do you have any idea the damage you almost caused this station? Or the repercussions?"

Finally Lars got his helmet off. "Doctor, please listen to us."

"They want to have you shot," said Tereskevitch. "They're quite serious. Fortunately—for you—we don't have an armory up here."

"Dr. Tereskevitch," Lars snapped, "while we stand here bickering, you may be destroying yourselves—and maybe the entire human race!"

"Huh?"

"You wouldn't listen to all our theory. How the dinosaurs destroyed themselves. We believe that the type of war they waged was biological. If the individual you found was placed in suspended animation after that conflict, every part of him—every organ, every cell—must have been preserved intact. *And every living thing that might have been inside his body."*

Tereskevitch's jaw dropped.

Ellie reacted to the horror in Tereskevitch's face. "Oh, my God, Lars! We're too late!"

"No, no," stammered Tereskevitch. "Not yet. Maybe—"

He moved toward a sealed chamber. "Wait!" Lars said. "If that's where you've got him, you can't go in there now."

Resigned, the Russian turned back. "No, of course not. I wouldn't have anyway. The chamber's not supposed to be opened at all during the course of the experiment. My own orders ..."

"When did it start?" Lars asked.

"We—activated the pumps only a few moments before we got the call about your ship. Now it's into the moisture cycle." Tereskevitch smiled ruefully. "You should've been more prompt, Professor."

Lars sighed. "The damage's already done. You'd better radio Earth and advise what's happened."

Tereskevitch hesitated. "I'd prefer, ah, not to have to contact anyone down there just yet. The creature's isolated in the vacuum chamber. Surely, there's no danger."

"We can't be sure. If it's the actual biological agent, we have to presume—if only from what it did before—that it's extremely virulent and easily spread. Perhaps even through the seal of that door."

"I'd still prefer to wait. Professor, please try to understand. The decision to proceed was—not unanimous."

"Further delay may be too late. What if we're unable to get word out because we've *already* been infected?"

Tereskevitch turned to his companions and again spoke in Russian.

"Tell them every second we delay may be crucial," Lars urged.

"How can we believe *you*?" spoke up the third officer, the one most opposed to their previous visit. "This is

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all some sort of capitalist plot to destroy us and our station. Just as your unauthorized boarding was in clear violation of our sovereignty and—"

Tereskevitch cringed at the man's words.

Lars did better. He voiced what must have been his Soviet counterpart's thoughts: "Oh, don't be an ideological ass! Anything happens up here, you think your leaders'll let any American spacecraft near? It'll be *your* cosmonauts transmitting the disease down to *your* country first."

Tereskevitch resumed arguing in Russian. The other man waivered, then rushed to the ladder and speedily clambered upward.

"He's going to the communications center," said Tereskevitch.

"But will he send the message?" said Lars.

"Dr. Tereskevitch," Ellie asked, "how did you discover that the specimen was actually alive?"

Grateful for the diversion, Tereskevitch said, "When our cosmonauts brought the body on board their craft, I sent specific instructions to keep it exposed to the vacuum. I was afraid of deterioration. Once they got it back here, we stored it in this vacuum chamber. Conducted all preliminary tests in the chamber. We placed tissue samples in a sealed air tank. Nothing happened then. It was only a few days ago—we were interested in the dehydration—we added water. To our utter astonishment, the tissue not only absorbed the fluid but retained it, and—incredibly—began to *use* it. It gave all the appearance of cellular division, growth."

"But what precautions did you take during all this?" Lars insisted.

"Professor—we are not peasants sticking our boots in manure to hear them squish. Whatever you Americans think of our scientific methods, we took what we considered appropriate precautions. We were concerned about contamination. From us, of course, not from it. But it amounts to the same thing. Everything was handled by remote instrumentation, the way we do radioactive materials. So even if you hadn't come thundering onto the scene like your beloved cavalry, there probably would've been no direct exposure anyway."

"Probably?"

"All right. Maybe we'd have sent someone inside eventually. Only not without proper testing first. I don't work that way, Professor. Nobody—and I mean not one person aboard this station, whatever his authority"—Tereskevitch glanced significantly at the man who earlier argued to hear Lars and Ellie out—"would dare enter that chamber without my direct permission and supervision. I don't care what's going on inside. And up to this point, nothing of note has."

"So far as you know. Since you commenced the tests on the tissue sample, has anyone returned to Earth?"

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"No, Professor. I can assure you of that. In fact, your ship was the first to leave *Gagaringrad* since then."

"Which means *we* could have been the ones to spread the contagion!"

There was nothing Tereskevitch could say to that.

Instead, he took refuge in his explanation. "When we removed the water and air, the tissue sample stopped its activities. But it didn't die. Exposed to a vacuum, the only appreciable effect was to allow the fluid to exit without apparent damage to the cellular structure. So, becoming dormant, it resumed growing when again placed in air and water.

"Obviously, this was a process totally unknown to our science. The implications were staggering. After much deliberation up here—ground control knew as little as you did, Professor—we determined that there really was only one course for us to follow: place the entire creature in an environment that offered the best chance to revive it."

"Of course," added Lars, "you had no intention of sharing this experiment with anyone from the United States. Hence the secrecy, even from your own people."

The degree of bitterness shocked Ellie. How often had she tried to get Lars to see people as they truly were? Now she realized what a real loss that would be.

Tereskevitch sensed it too. "I could say that events dictated what we've done. We had no way of knowing what effect removing the body from its resting place would have. The fact that the experiment had to be conducted up here in a true vacuum. Time working against us..."

"But that wouldn't be the whole story, would it, Dr. Tereskevitch?"

"Why should we have shared this discovery with you?" Tereskevitch became increasingly defensive. "Would you Americans have been any more generous in our place? Besides—twenty years ago you had your chance on the moon. Now it's our turn."

Ellie couldn't stand this any longer. Besides, there was something much more important going on.

"Dr. Tereskevitch," she said, "is there some way to observe what's taking place inside the chamber?"

"We have television cameras inside. Over here's a monitor. I haven't yet been able to switch it on. Your untimely arrival—"

"Do so, man!" Lars cried, all resentment vanishing immediately.

The television screen waivered as Tereskevitch focused on a shape lying on a padded table. Then the camera dollied inward. Ellie's intake of breath was the only sound as Soviets and Americans crowded in front of the monitor.

At first it was difficult to observe. Clouds of steam filled the chamber, wreathed about the figure like the mists it may once have walked among 65 million years before on Earth.

It had wide saurischian hips, thick legs, and a full dinosaur tail—a victory for Ellie's position earlier—but

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the arms and shoulders were proportioned like those of a man. The one hand in view, though oversized, had no claws and one of the three fingers opposed the others. More they could not tell because of the wrinkled, dried-out appearance of the body. Yet as they watched, the contours began to fill out, the wrinkles slowly disappear, the body take on weight and color, changing from dead ash to living flesh.

"It seems to be rejuvinating itself from the moist air alone," said Lars.

"You see," Tereskevitch said to his companion, "your worries were all for nothing." To Lars and Ellie: "We're basing this procedure on numerous tests with the tissue samples. The air inside is saturated with as much humidity as possible. The body cells are refilling with water at a greatly accelerated, but not dangerous, rate. Total immersion in water would have been too much. Caused the cells to burst."

"Is it possible to focus for a close-up view?" Ellie requested.

"I'm not sure what we'll see with all that steam, but ..." The Soviet scientist complied, and the upper body filled the screen.

Most saurian characteristics were muted. The snout was greatly foreshortened, the mouth shrunk to less than twice the width of a human's. The large oval eyes—actually the eyesockets, the most prominent reptilian characteristic retained—were set close together in the center of the face, the enlarged cranium above promising a brain the equal to man's—if not greater.

"Despite everything, so much like us," Lars marvelled. "He resembles his reptilian forebears as little as we do the ape."

"I wonder if he really is male," said Ellie.

When the Russians glanced at her, she declared, "Well, it's a logical question. Reptiles don't have external genitalia, male or female. And it certainly wouldn't have breasts. It's not mammalian, after all."

Tereskevitch became embarrassed.

Stifling a laugh, Lars said, "For now, he's officially—if tentatively—male. Don't want to complicate things too much."

"Dr. Tereskevitch!" the other Russian exclaimed.

Slowly the creature began to clench his fists.

"He seems to be stretching," said Lars. "Like awakening from a long sleep. Doctor, do you have an intercom into the chamber?"

"Of course. Stupid. How could I forget?"

Quickly Tereskevitch flicked a switch.

From inside the chamber came sounds of movement. The creature stirred, tried to rise, fell back. *Almost painfully,* thought Ellie.

Now, a kind of chirping. There was nothing else in the chamber that could be causing it. It had to be coming from the creature.

"Speech?" said Lars. "Listen how strained it sounds."

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The creature stopped moving. But the same sound kept being repeated, growing louder, more insistent.

Lars turned to Ellie. The two paleontologists realized the same thing: "Something's wrong with him!"

"Not necessarily," said Tereskevitch. "We'll keep watching."

"No, dammit!" snapped Lars. "Look at him."

The face in the monitor. Tereskevitch hadn't worked with fossils, never reconstructed what they must have looked like. He couldn't see the agony that Lars and Ellie did.

"It must be water, Lars," said Ellie. "He's not getting enough from the air."

"There is some in the chamber?" Lars asked Tereskevitch.

"Of course. I'll get it to him."

Tereskevitch grasped two handles below the monitor. On the screen, two mechanical arms appeared. One moved toward the creature on the table, a clear beaker clutched in its metal claw.

Both the creature's eyes snapped open. He saw the approaching arm through the clouds of steam, drew back feebly.

"He doesn't understand," Lars said.

"No, that can't be," said Tereskevitch. "He's intelligent. He's got to know we're only trying to help."

"But he doesn't," Lars said. "Maybe there's nothing in his experience anything like what you're putting him through."

Now the creature raised a three-fingered hand toward the beaker.

"There, you see," Tereskevitch started to say.

"No. Don't," Ellie cried.

He wasn't trying to reach for the container. He was trying to push it away.

Swearing, Tereskevitch grasped with both hands the left handle, trying to regain control of the mechanical arm and pull it back.

"We can't help him *this way*," said Lars.

It was the way he said it. Ellie turned toward him hoping she was wrong.

"Lars, you're not thinking of going inside there with him?"

"Somebody has to."

"But the disease—"

"That's why it has to be only one of us. The rest of you clear out. Seal off the entire area."

Tereskevitch protested, "I can't let you do that."

"Precautions be damned. You started this. Now that he's revived, we've got to do whatever we can to save him."

"I didn't mean that. *You,* Professor. I can't let you kill yourself."

Lars ignored him. "Ellie, use your suit radio to contact Bradley. Tell him what's happened. Have him relay it back to Earth."

"I can't just leave you," she said helplessly.

"You must. That message has got to get through. We don't know if their man sent anything. You're the only

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person I can trust to do it and make them understand. Now please go. *All of you!*"

Tereskevitch's associate slipped behind Ellie to the ladder. She couldn't make herself leave. All she could do was stare at big, clumsy generous Lars, who wouldn't even be there if it hadn't been for her.

Suddenly she was running to him, throwing her arms about him, the tears streaming down her cheeks.

Without any idea whether she made it to the ladder by herself or with Lars' help, Ellie began the long climb upwards. All she knew was that Lars was right. The message had to get out. Otherwise, she'd still be there with him.

Passing through the ceiling hatch, she saw that the first Russian had already reached the next compartment. How many more after that? Ten? Twelve?

As the hatch beneath slammed shut and locked, Ellie suddenly realized that Tereskevitch had not come up with either of them.

He was still down by the chamber with Lars.

Descending from the ladder, Tereskevitch asked, "Why are you doing this?"

Lars had been studying the complicated pump handle to the chamber door. "Get the hell out of here!" he said, without looking up.

"Not without knowing why you're so set on becoming a martyr," said Tereskevitch. "If you think your death will give your country some sort of claim to our find—? But no, it's not that with you, is it?"

"The door," said Lars, "how do I get it open the quickest way?"

"Personal glory then? Your name attached to what happens today? Your own life vindication for everything you've stood for?"

Lars straightened to his full height. Between the two men was the monitor, with the creature's tormented face a visage even Tereskevitch could now understand.

"Isn't that reason enough?"

Tereskevitch glanced at the monitor, then slowly nodded.

"And you," said Lars. "Why are you still here?"

"Because," said Tereskevitch, "it takes *two* people to get that damned door open in time."

Lars looked at him. "Who in blazes designed such a monstrosity?"

Tereskevitch shrugged. "A time and efficiency study committee. Who else?"

Lars began to laugh. Heartily, uproariously. And Tereskevitch, after only a moment's hesitation, joined in.

Both men were still laughing as they worked together to open the chamber door.

"There really wasn't any danger after all."

Lars and Ellie were relaxing in the small cabin assigned to them in their first moments alone after Lars' release from the chamber. The statement he'd just made was one of the few

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things he could say with any degree of certainty.

"But we were right about it being some sort of disease," said Ellie.

"Yes, even though the exact type of pathogen still hasn't been determined. But at least we have an idea how it worked. It didn't kill or cripple. Just attacked the sex cells, making it impossible for his species to reproduce."

"As well as any other species," added Ellie.

"Of dinosaur. That limitation's important. Not merely for the clue it provided us. But as an added safeguard. Whether it would affect mammals—particularly man—is an open question. One we'll never have to find out. Thank God."

"Can we really be sure?"

"Based on what we've learned, yes. We know that it thrived only on *living* gametes and that it had no dormant cycle. Once it completed its horrid work, there was nothing further to sustain it. So when our guest entered suspended animation, any residue in his body *had* to be dead."

Ellie could tell by the off-hand manner he spoke that Lars was trying to minimize what he'd done. But she knew better. "You couldn't have known that *before* entering that chamber."

"No. But we should've guessed it. After all, precautions surely would have been taken to insure that the disease didn't spread any more after he was found and revived."

"Maybe," said Ellie, thinking of all those other species that vanished—the ones without intelligence.

"Anyway, the Soviet doctors went to great pains to make sure that there wasn't anything in our bloodstreams not easily identifiable before releasing Serge and me. *Our* pains, that is." Lars grinned, again making light of what took place for Ellie's benefit.

So now it's 'Serge,' thought Ellie. She'd come to doubt that Dr. Tereskevitch had a first name.

Despite the present atmosphere of camaraderie, she still didn't trust their Soviet hosts. All the Americans, Bradley and his copilot included, were temporarily quarantined aboard *Gagaringrad.* Ellie had insisted upon staying with Lars. Quite a few Russian eyebrows had been raised at this.

"With all their testing," said Ellie, "I just hope they don't forget one thing: *You* were the one who saved his life. Don't deny it, Lars. Dr. Tereskevitch never would have gone in there if it hadn't been for you. You know that's true."

"Oh, I'm not so sure about that," Lars disputed. "Serge's pretty hardheaded. But he did the right thing when it counted. And I think he'd have done it whether I was there or not. You ought to get to know him, Ellie. I think you two would get along just fine."

"Ugh! I'd rather spend my time with—Herman. I guess we can call him that—now that we know he's definitely male—until we find out his real name."

"That won't be for some time. Between the shock of revival and all he

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tried to do, we'll probably be sleeping for days. He tried to tell us so much. Tried to get across so much more we couldn't grasp."

"I still can't believe that you actually *talked* with him!"

"Don't credit us with that. It was entirely his doing. Learned enough of our language from the few words we were using to start conversing after just half an hour!" Lars shook his head in renewed amazement.

Lars had already related to Ellie how they managed to communicate. The "trilling" had originated from lower in the throat than the human voicebox. Lars' earlier analogy to the parrot's syrinx had been close. But the range of sounds produced surpassed even a human's. And they were spoken at a much faster rate.

It was the being who recognized this and adjusted his own speech patterns to the comparative slowness of the lower-pitched words spoken by Lars and Tereskevitch.

"W-a-a-a-a-ter-r-r-r-r," he had uttered, exaggerating the syllables with an underlying "hissing"—precisely the type of sound one would have associated with a reptile.

From this, he picked up human speech rapidly, never forgetting a word once he'd spoken it. Within minutes, he had acquired a sufficiently large vocabulary to assure his rescuers that they had nothing to fear from him.

"I suppose we shouldn't have been too surprised," said Lars to Ellie. "There are people with photographic memories. Math geniuses. Why shouldn't *he* have turned out to be some sort of language genius? After all, what would've been the purpose of sending a messenger if he couldn't communicate!"

He grinned wickedly. "Of course, Serge couldn't help being a bit miffed. We were speaking English, in deference to me, and *that's* the language he picked up on. I don't think he learned a single word of Russian the whole time!"

Ellie burst out laughing. She hadn't realized how much she needed to. And she didn't give a damn if it were picked up by any of the microphones she was certain the Russians had stashed about the cabin.

"Actually, I doubt if Serge cared all that much. He was really interested in one thing. Couldn't wait until there were enough words learned to ask him how he got to the moon. Herman—oh, that doesn't fit him, Ellie; *Hermes* is much more appropriate—Hermes couldn't answer at that point. Guess I'd have trouble too, if I'd only been speaking English for an hour!"

Ellie envied him—both of them—for those precious moments at the very beginning—when a new day for science had dawned and dark clouds not yet settled.

"The only way we could continue," Lars said, "was by explaining to him how we got there ourselves. Help him build up his vocabulary. Yet we couldn't get beyond the basics of rocketry. He kept on interrupting.

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Couldn't seem to understand why we'd ignored the greatest power source available—our own planet!"

"What could he have meant by that?"

"Serge's the engineer. He figures some sort of antigravity drive. Only Hermes didn't have the capability to supply a lot of detail. We're reasonably certain it wasn't done through any instrumentation we're familiar with. Throughout the discussion, he kept pointing to his head."

"Sounds like he just willed himself to go to the moon."

"No. That's not it either. Obviously, they needed protection from the vacuum of space, same as us. And they did use spacecraft of some type, although apparently quite different from what we have. It seems that their minds formed a vital component."

"Oh, Dr. Tereskevitch must have loved *that.*"

"Actually, Serge was quite impressed. Don't forget, the Soviets have done much more in the fields of psychic energy, Kirlian photography, ESP, than we have. If there's a way, mentally, to tap the energy fields of Earth, you can be sure they wouldn't reject it out of hand. Not the way most Western scientists rejected our theory."

Lars hesitated. Obviously, there was a great need in him to go on. But also great reluctance. Usually Ellie would have resented such protectiveness. Now she wasn't so sure.

"You can see the difficulties we were getting into already. The English language, Ellie, is such a marvelous tool. With just 150 words, you can make yourself understood in most common situations. Trouble is the intricacies after that point. What I've told you so far—however sketchy—at least there's little doubt what he was trying to get across. But the rest of it—well, you've got to bear in mind the handicap Hermes was working under, not being familiar with the wide variety of meanings that attach to words. And maybe a lot of it's merely Serge's or my interpretation. I don't know. In a way, I almost hope..."

Ellie understood. "The reason they destroyed themselves?"

Lars nodded. "Some of it makes sense. Much of it doesn't. The way they went about it: if you *are* going to eliminate someone, can you think of a more *benevolent* way of doing it? No death or destruction. Just stop all their births.

"But the destruction of other life forms—the *universality* of the tragedy—they couldn't have deliberately intended that. Not from what I've learned about them from Hermes."

Oh, sure, thought Ellie. *A little miscalculation. Happens all the time. Sorry.*

"Maybe that was the most horrifying thing of all to them," said Lars. "His people really were closely attuned to the natural processes of their world at one time. That comes out of almost everything he says. But gradually that changed. They turned away from what

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had previously sustained them. Began modifying their environment. Became more mechanical."

"In other words," said Ellie, "their civilization became more like ours?"

"I suppose so—although I wouldn't quite characterize it like that."

Ellie wasn't surprised. "And that, naturally enough, led to the war?"

"No. Not a war. At least, not the way we think of one. Something happened. Whether a single catastrophic event or a whole series of them, we're not sure. We know that the net result was so terrible that Hermes won't speak of it other than to acknowledge that it did occur. That led to the decision on their part. He wouldn't—perhaps couldn't—say who made it or how it was arrived at. But this much we do know: What they did was to commit *deliberate racial suicide.*"

Ellie shuddered at his words.

"It would help if I could believe I misunderstood him," said Lars. "How can anyone come to the conclusion—as they apparently did—that all intelligence is an aberration? Maybe you can make sense out of that, Ellie. I can't," he said helplessly.

Ellie studied the cold metal walls about them. Very little made sense now. More questions than answers. Each new discovery more terrible in its implications. The dark clouds in this new day of science had indeed descended.

She knew that Lars had to find some way to reconcile this. He'd devote the rest of his life—in any event—helping and studying this being whose life he'd saved. But for Lars this—this anomaly could not stand.

For Ellie there was a much more vital concern.

"Why did Hermes survive? A messenger from their time? I can't believe that, Lars. Why would people who destroyed all intelligence—and almost their entire world as well—*care* about the future?"

"Maybe he was sent to guide us," suggested Lars. "Insure that we don't make the same mistakes they did."

Ellie expected Lars to say something like that. Why should he think the worse of anyone—or anything?

"What if it's more than that?" she said.

"What else could it be?"

"To *judge* us."

Lars looked at her. He had been closest to their Hermes. Closer probably than Tereskevitch. Ellie knew what was going through his mind. Why had he failed to detect that? Because of what he truly observed? Or because of the type of person he was?

"What do we do then, Lars? We don't know the full extent of the powers he has. What he's capable of. He could destroy *us,* just like—"

"The answer's simple, Ellie. We'll just have to convince him that we are worthy. And maybe we've already made a big step in that direction, Serge and me."

The smile on Lars Hansen's face made Ellie almost forget her fears.

Almost. ■

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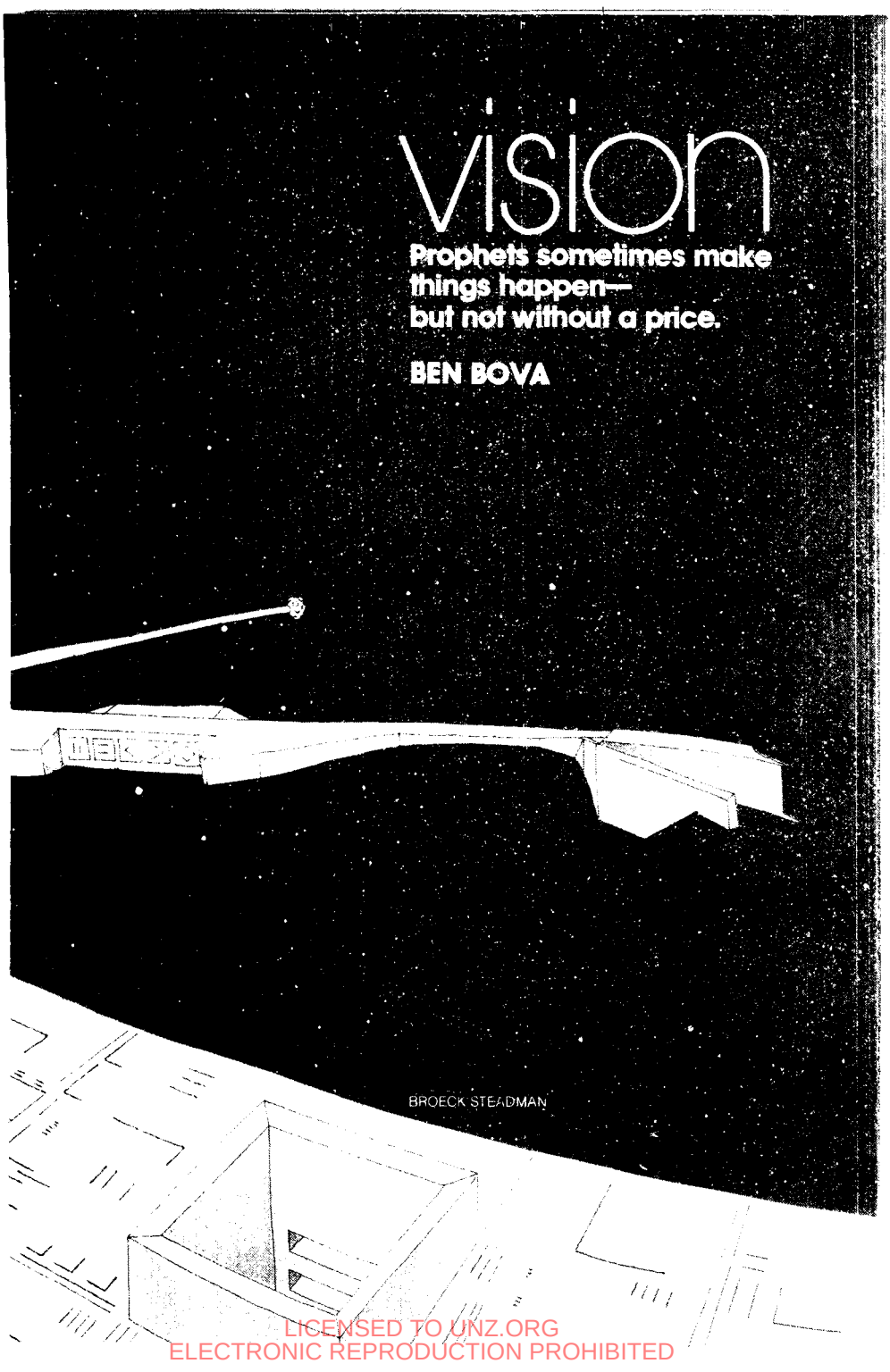

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"But if you live in orbit, you can live forever!"

Don Arnold said it in sheer frustration and immediately regretted opening his mouth.

Picture the situation. Don was sitting under the glaring lights of a TV studio, in a deep fake-leather couch that looked comfortable but wasn't. His genial talk show Host had ignored him totally since introducing him as "one of NASA's key scientists." (Don was a NASA engineer, and pretty far from the top.)

On one side of Don sat a UFOlogist, balding, owlishly-bespectacled, with a facial tic and a bulging briefcase clutched in his lap, full of Important Documents.

On Don's other side sat a self-proclaimed Mystic of indeterminate age, a benign smile on his face, his head shaved and a tiny gem sparkling in his left earlobe.

They had done all the talking since the show had started, nearly an hour earlier.

"The government has all sorts of data about UFO's," the UFOlogist was saying, hugging his battered briefcase. "NASA has *tons* of information about how the saucers are built and where they're coming from, but it's all classified and they won't release any of it to the people."

Before Don could reply, the Mystic raised both his hands, palms outward. The cameras zoomed in on him.

"All of the universe is a single entity, and all of time is the same," he said in a voice like a snake charmer's reed flute. "Governments, institutions, all forms of society are merely illusions. The human is capable of anything, merely by thinking transcendentally. The soul is immortal . . ."

That's when Don burst out, "But if you live in orbit, you can live forever!"

It surprised them all, especially Don. The Mystic blinked, his mouth still silently shaped for his next pronouncement. The UFOlogist seemed to curl around his briefcase even tighter. The studio audience out there beyond the blinding glare of the overhead lights surged forward in their chairs and uttered a collective murmur of wonderment.

Even the talk show's Host seemed stunned for just a moment. He was the best-dressed man on the set, in a deep blue cashmere sports jacket and precisely-creased pearl gray slacks. He was the only man on camera in make-up. His hairpiece gave him a youthful-yet-reliable look.

He swallowed visibly as Don wished he could call back the words he had just blurted.

"They live forever?" the Host asked, so honestly intrigued that he forgot to smile.

How in hell can I backtrack out of this? Don asked himself desperately.

Then the Mystic started to raise his hands again, his cue to the cameras that he wanted their attention on him.

"Our studies have shown that it's possible," Don said, leaning forward slightly to stare right into the Host's baby-blue eyes.

"How long have people lived in or-

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bit, anyway?" the Host asked.

"The record is held by two Russian cosmonauts, aboard their Salyut 6 space station. They were up there for almost six months. Our Skylab team was up for 83 days, back in '73-'74."

Don could sense the UFOlogist fidgeting beside him, but the Host asked, "And they did experiments up there that showed you could live longer if you stayed in space?"

"Lots of experiments have been done," Don answered before anyone else could upstage him, "both in orbit and on the ground."

"On . . . immortality."

"We tend to call it life extension," he said truthfully. "But it's quite clear that in orbit, where you can live under very low-gravity conditions, your heart doesn't have to work so hard, your internal organs are under much less stress . . ."

"But don't your muscles atrophy? Isn't there calcium loss from the bones?"

"No," Don said flatly. All three cameras were aimed squarely at him. Normally he was a shy man, but nearly an hour of listening to the other two making a shambles of organized thought had made him sore enough to be bold.

"There isn't?"

"It takes a lot of hard work to move around in low gravity," Don answered. "With a normal work routine, plus a few minutes of planned exercise each day, there's no big muscle tone loss. In fact, you'd probably be in better condition if you lived in a space station than you are here on Earth."

"Fascinating!" said the Host.

"As for calcium loss, that levels off pretty quickly. It's no real problem."

"And then you just go on living," the Host said, "forever?"

"For a long, long time," Don hedged. "In a space station, of course, your air is pure, your water's pure, the environment is very carefully controlled. There are no carcinogens lousing up the ecology. And you have all the benefits of low gravity."

"I never knew that! Why hasn't NASA told us about this?"

As Don fished around in his mind for a reply, the Host turned on his smile and fixed his gaze on Camera One.

"Well, it always seems that we run out of time just when things get *really* interesting." Glancing back along his guests on the couch, he said, "Dr. Arnold, that was fascinating. I hope you can come back and talk with us again, real soon."

Before Don could answer, the Host said farewell to the two other guests, mispronouncing both their names.

Don sat up in bed, his back propped by pillows, the sheet pulled up to his navel. It was hot in the upstairs bedroom now that they had to keep the air conditioner off, but he stayed covered because of the twins. They were nine now, and asking pointed questions.

Judy was putting them into their bunk beds for the night, but they had a habit of wandering around before they finally fell asleep. And Judy,

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good mother that she was, didn't have the heart to lock the master bedroom door. Besides, on a sultry night like this, the only way to catch a breath of breeze was to keep all the doors and windows open.

Don played a game as he sat up watching television, with the remote control wand in his sweating hand. He found the situation comedies, police shows, doctor shows, even the science fiction shows on TV so boring that he couldn't bear to watch them for their own sake.

But they were tolerable—almost—if he watched to see how much space-inspired technology he could identify in each show. The remote monitors in the surgeon's intensive care unit. The sophisticated sensors used by the coroner's hot-tempered pathologist. The pressure-sensitive switch on the terrorists' bomb planted in the cargo bay of the threatened 747.

Judy finally came in and began undressing. The bedroom lights were out, but there was plenty of light coming from the TV screen.

"Better close the door, hon," Don told her as she wriggled her skirt down past her hips. "The twins . . ."

"They're both knocked out," she said. "They spent all day in the Cramers' pool."

"Still . . ." He clicked off the TV sound and listened for the patter of nine-year-old feet.

His wife's body still turned him on. Judy was short, a petite dark-haired beauty with flashing deep-brown eyes and a figure he thought of as voluptuous. She stripped off her panties and crawled into the bed beside Don.

Grinning at him, she said, "You worry too much."

"Yeah, maybe I do."

"I thought you were terrific on the show this afternoon. I got so mad when those other two clowns kept hogging the camera!"

"Maybe I should have let them hog it for the whole show," he said.

"No you shouldn't! I sat here for nearly an hour waiting for you to open your mouth."

"Maybe I should've kept it closed."

"You were terrific," she said snuggling closer to him.

"I was lying," he answered. "Or at least, stretching the truth until it damn' near snapped."

"You looked so handsome on television."

"I just hope nobody at Headquarters saw the show."

"It's a local talk show," Judy said. "Nobody watches it but housewives."

"Yeah . . ."

He started to feel better, especially with Judy cuddling next to him, until almost the very end of the eleven o'clock news. Then they showed a film clip of him staring earnestly into the camera (*I thought I was looking at the Host*, Don thought) and explaining how people who live in orbit will live forever.

Don saw his whole career passing in front of his eyes.

He made sure to get to his office

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early the next morning, taking a bus that arrived on Independence Avenue before the morning traffic build-up. Don was at his desk, jacket neatly hung behind the door and shirt sleeves rolled up, going over the cost figures for yet another study of possible future options for the Office of Space Transportation Systems, when his phone buzzed.

"Uncle Sam wants *you*," rasped Jack Hardesty's voice in the phone receiver.

He saw the show! was Don's first panicked thought.

"You there, Mr. Personality?" Hardesty demanded.

"Yeah, Jack, I'm here."

"Meet me in Klugie's office in five minutes." The phone clicked dead.

Don broke into a sweat.

Otto von Kluge was as American as the Brooklyn Bridge, but many and various were the jokes around NASA Headquarters about his name, his heritage, and his abilities. He was an indifferent engineer, a terrible public speaker, and a barely-adequate administrator. But he was one of the few people in the office who had a knack for handling other people—from engineers to congressmen, from White House Whiz Kids to crusty old accountants from the Office of Budget and Management.

Despite the low setting of the building's air conditioning, von Kluge wore his suit jacket and even a little bow tie under his ample chin. Don always thought of him as a smiling, pudgy used-car salesman. But once in a great while he came across as a smiling, pudgy Junker land baron.

Hardesty—bone-thin, lantern-jawed, permanently harried, was already perched on the front half-inch of a chair at one side of von Kluge's broad desk, puffing intensely on a cigarette. Don entered the carpeted office hesitantly, like a prisoner on his way to the guillotine.

Von Kluge grinned at him and waved a hand in the general direction of the only other available chair.

"Come on in, Don. Sit down. Relax."

Just like the dentist says, Don thought.

"The TV station is sending me a tape of your show," von Kluge said, with no further preliminaries.

"Oh," Don said, feeling his guts sink. "That."

Laughing, von Kluge said, "Sounds to me like you're bucking for a job in the PR department."

"Uh, no, I'm not. . . I mean. . ."

"Sounds to *me*," Hardesty ground his cigarette butt into von Kluge's immaculate stainless steel ashtray, "like you're bucking for a job selling brushes door-to-door!"

"Now don't get your blood pressure up, Jack," von Kluge said easily. "Most of the crimes of this world come out of overreacting to an innocent little mistake."

An overwhelming sense of gratitude flooded through Don. "I really didn't mean to do it," he said. "It's just. . ."

"I know, I know. Your first time on television. The thrill of show business.

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The excitement. Takes your breath away, doesn't it?"

Don nodded. Hardesty glowered.

"Let's just see the tapes and find out what you really said," von Kluge went on. "I'll bet you don't remember yourself, do you, Don?"

"No . . ."

Shrugging, von Kluge said, "It's probably no big deal. We'll just play it cool until it all blows over."

His office door opened slightly and Ms. Tucker, a black secretary of such sweetness and lithe form that she could make bigots vote pro-bussing, said softly:

"Phone for you, Dr. von Kluge."

"I can't be disturbed now, Alma."

"It's Senator Buford," she said in a awed whisper.

Von Kluge's eyes widened. "Excuse me," he said to Don and Hardesty as he picked up the phone.

He smiled broadly and said, "Senator Buford sir! Good morning! How are you . . ."

And that was all he said for the next twenty-two minutes. Von Kluge nodded, grunted, closed his eyes, gazed at the ceiling, stared at Don. As he listened.

Finally he put the phone down, slowly, wearily, like a very tired man at last letting go of an enormous weight. His ear was red.

Looking sadly at Don, von Kluge said, "Well, the Senator wants you to appear at his Appropriations Committee hearing. Tomorrow morning."

Don expected the hearing chamber to be packed with newsmen, cameras, lights, crowds, people grabbing at him for interviews or comments.

Instead, the ornate old chamber was practically empty, except for the few senators who had shown up for their committee's session and their unctuous aides. Even the senators themselves seemed bored and fidgety as a series of experts from various parts of NASA and the Office of Management and Budget gave conflicting testimony on how much money should be appropriated for the space program.

But flinty old Senator Buford, the committee's chairman, sat unflinchingly through it all. His crafty gray eyes drilled holes through every witness; even when he said nothing, he made the witnesses squirm in their seats.

Don was the last scheduled witness before the lunch break, and he kept hoping that they would run out of time before they called on him. Hardesty and von Kluge had drilled him all night in every aspect of the space agency's programs and budget requests. Don's head hadn't felt so burstingly full of facts since his senior year in college, when he had crammed for three days to get past a Shakespeare final exam.

By the time Don sat himself cautiously in the witness chair, only four senators were left at the long beige-covered table facing him. It was a few minutes past noon, but Senator Buford showed no inclination to recess the hearing.

"Mistah Arnold," Buford drawled,

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"have you prepared a statement for this committee?"

"Yes, sir, I have." Don leaned forward to speak into the microphone on the table before him, even though there was no need to amplify his voice in the nearly-empty, quiet room.

"In view of the hour," Buford turned *hour* into a two-syllable word, "we will dispense with your reading your statement and have it inserted into th' record as 'tis. With youh permission, of course."

Don felt sweat beading on his forehead and upper lip. "Certainly, sir." His statement was merely the regular public relations pamphlet the agency put out, extolling its current operations and promising wonders for the future.

Senator Buford smiled coldly. Don thought of a rattlesnake coiled to strike.

"Now what's this I heah," the Senator said, "'bout livin' in space prolongin' youh life?"

Don coughed. "Well, sir, if you're referring to . . . ah, to the remarks I made on television . . ."

"I am, suh."

"Yes, well, you see . . . I had to oversimplify some very complex matters, because . . . you realize . . . the TV audience isn't prepared . . . I mean, there aren't very many scientists watching daytime television talk shows . . ."

Buford's eyes bored into Don. "Ah'm not a scientist either, Mr. Arnold. I'm jest a simple ol' country lawyer tryin' to understand what in the world you're talkin' about."

And in a flash of revelation, Don saw that Senator Buford was well into his seventies. His skin was creased and dry and dead-gray. The little hair left

N TIMES TO COME

There's an old saying that, "A little knowledge is a dangerous thing." What do you do if knowledge is your stock in trade—because you're a teacher—and you belatedly discover that you're literally teaching your pupils into extinction? It could happen—if there's something you don't know about your students. That's the take-off point for "Savage Planet," February's lead novelette by Barry Longyear. It's Longyear's first appearance in Analog, but "Savage Planet" is a powerful tale very much in the Analog tradition—with a powerful cover by Kelly Freas.

The Freas cover is part of our all-year Fiftieth Anniversary celebration. Another is a new story from Raymond Z. Gallun, who appeared very often in Astounding's first years, then only occasionally for a long time, and is now picking up steam again. His February story takes a close look at how recent events have changed our ability to cope with alien contact. Are you sure you know . . . .?

In addition, we'll have the conclusion of One-Wing, *by Lisa Tuttle and George R.R. Martin, an article on "How to Get Along with an Extraterrestrial . . . Or Your Neighbor," by G. Harry Stine, and all the short stories and regular features that will fit.*

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on his head was wispy and white. Liver spots covered his frail, trembling hands. Only his eyes and his voice had any spark or strength to them.

A phrase from the old Army Air Corps song of Don's childhood skipped through his memory: *We live in fame or go down in flames.*

Taking a deep breath and sitting up straighter in the witness chair, Don said, "Well, sir: there are two ways to look at any piece of information—optimistically or pessimistically. What I'm about to tell you is the optimistic view. I want you to understand that clearly, sir. I will be interpreting the information we have on hand in its most optimistic light."

"You go right ahead and do that," said Senator Buford.

They lunched in the Senate dining room: dry sherry, mock turtle soup, softshell crabs. Just the two of them at a small table, Don and Senator Buford.

"I finally got me a NASA scientist who can talk sense!" Buford was saying as he cut through one of the little crabs.

Don's head was still reeling. "You know, Senator, that there will be lots of experts inside NASA and outside who'll make some pretty strong arguments against me."

Buford fixed him with a baleful eye. "Mebbe so. But they won't get away with any arguments 'gainst *me,* boy."

"I can't guarantee anything, you realize," Don hedged. "I could be completely wrong."

"Ah know. But like you said, if we don't *try*, we'll never know for sure."

This has got to be a dream, Don told himself. *I'm home in bed and I'll have to get up soon and go testify before Buford's committee.*

"Now lessee what we got heah," Buford said as the liveried black waiter cleared their dishes from the table. "You need the permanent space station—with a major medical facility in it."

"Yessir." Don took a breath. "And the all-reusable shuttle."

Buford looked at Don sharply. "What's wrong with th' Space Shuttle we got? Cost enough, didn't it?"

"Yessir, it did. But it takes off like a rocket. Passengers pull three or four gees at launch. Too much for . . .er, for . . ."

"For old geezers like me!" Buford laughed, a sound halfway between a wheeze and a cackle.

Don made his lips smile, then said, "An advanced shuttle would take off like an airplane, nice and smooth. Anybody could ride in it."

"Uh-huh. How long'll it take to get it flyin'?"

Don thought a moment, considered the state of his soul, and decided, *What the hell, go for broke.*

"Money buys time, Senator," he said carefully. "Money buys time."

Senator Buford nodded and muttered, mostly to himself, "I finally got a NASA scientist who tells me the truth."

"Sir, I want you to realize the *whole* truth about everything that I have been

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telling you. . ."

But Buford wasn't listening. "Senator Petty will be our major obstacle. Scrawny little Yankee. . . thinks he's God's chosen apostle to watch out over the Federal budget. He'll give us trouble."

The name of Senator Petty was known to make scientists weep. NASA administrators raced to the bathroom at the sound of it.

Buford waggled a lean, liver-spotted hand in Don's general direction. "But don't you worry none 'bout Petty. Ah'll take care o' him! You just concentrate on gettin' NASA to bring me a detailed program for that space station—with th' medical center in it."

"And the advanced shuttle," Don added, in a near whisper.

"Yeh, of course. The advanced shuttle, too. Cain't ride up there to your geriatrics ward in th' sky on a broomstick, now can I?"

"The twins were twelve years old today."

Don looked up from the report he was writing. It had been nearly midnight by the time he'd gotten home, and now it was well past one.

"I forgot all about their birthday," he confessed.

Judith was standing in the doorway of his study, wrapped in a fuzzy pink housecoat. There were lines in her face that Don hadn't noticed before. Her voice was more sharp than he'd remembered.

"They could both be in jail for all you think about them!" she snapped. "Or me, for that matter."

"Look honey, I've got responsibilities. . ."

"Sure! The big-shot executive. All day long he's running NASA and all night long he's out at parties."

"Meetings," Don said defensively. "It's tough to deal with congressmen and senators in their offices . . ."

"Meetings with disco bands and champagne and lots of half-naked secretaries prancing around!"

"Judy, for God's sake, I'm juggling a million and one details! The space station, the flyback shuttle booster, and now Senator Buford's in the hospital . . ."

"I hope he drops dead and Petty cuts your balls off!" Judith looked shocked that the words could have come from her mouth. She turned and fled from the room.

Don gave out a long, agonized sigh and leaned back in his desk chair. For a moment he wanted to toss the report he was writing into the wastebasket and go up to bed with his wife.

But he knew he had to face Senator Petty the next morning, and he had to be armed for the encounter. He went back to his writing.

"I think you're pulling the biggest boondoggle this nation's ever seen, since the Apollo project," said Senator Petty, smiling.

Don was sitting tensely in a big leather chair in front of the Senator's massive oak desk. On Don's left sat Reed McCormack, NASA's Chief

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Administrator, the space agency's boss and childhood chum of the President. McCormack looked like a studious, middle-aged banker who kept in trim playing tennis and sailing racing yachts. Which was almost entirely true. He was not studious. He had learned early in life that you can usually buy expertise—for a song. His special talent was making people trust him.

Senator Petty didn't trust anyone.

From the neck up the Senator looked like a movie idol; brilliant white straight teeth (capped); tanned, taut handsome face (lifted, twice); thick, curly, reddish-brown hair (implanted and dyed). Below the neck, however, his body betrayed him. Despite excruciating hours of jogging and handball, his stomach bulged and his chest was sunken.

"A boondoggle?" McCormack asked easily. "Your colleagues in the Senate don't seem to think so."

Petty's smile turned acid. "Funny thing about my fellow senators. The older they are, the more money they want to appropriate for your gold-plated space station. Why do you think that is?"

"Age brings wisdom," said McCormack.

"Does it?" Petty turned his mud-brown eyes on Don. "Or is it that you keep telling them they can live forever, once they're up in your orbital old-age home?"

"I've never said that," Don snapped. His nerves were frayed, he realized, as much by Senator Buford's hospitalization as by Judith's and the kids' growing unhappiness at home.

"Oh, you've been very careful about what you've said, and to whom, and with what qualifications," Petty replied. "But they all get the same impression—live in space and you live forever. NASA can give you immortality, if you vote the funds for it."

"That is *not* our policy," McCormack said firmly.

"The hell it isn't," Petty snapped. "But old Bufe's terminal, they tell me. You won't have him to steer your outrageous funding requests through the Senate. And that means you'll have to deal with me."

Don knew it was true, and saw the future slipping away from his grasp.

"That's why we're here," McCormack said. "To deal."

Petty nodded curtly.

"If you try to halt construction of the space station, your colleagues will outvote you overwhelmingly," said McCormack.

"Same thing applies to the new shuttle," Don added.

Petty leaned back in his chair and steepled his fingers. "I know that. But I can slow you down. OMB isn't very happy with your cost overruns, you know. And I can always start an investigation into this so-called science of life-extension. I can pick a panel of experts that will blow your immortality story out of the water."

For the first time, McCormack looked uneasy.

"There's no immortality 'story,' " Don said, testily. "We've simply reported the conclusions of various

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studies and experiments. We've been absolutely truthful."

"And you've allowed the senators to believe that if they live in orbit they all can become Methuselahs." Petty laughed. "Well, a couple of biologists from Harvard and Berkley can shoot you down inside of a week—with the proper press coverage. And I can see to it that they get the coverage."

Don gripped the arms of his chair and tried to hold onto his temper. "Senator Buford is dying and you're already trying to tear down everything he worked to achieve."

Petty grinned mischievously. "You bet I am."

"What do you want from us?" McCormack asked.

The Senator's grin faded slowly.

"I said we're here to deal with you," McCormack added, speaking softly. "The President is very anxious to keep this program going. Its effect on the national economy has been very beneficial, you realize."

"So you say."

"What do you want?" McCormack repeated.

"The groundbased medical center that's going to be built as part of your life-extension program..."

"In your state?"

"Yes."

McCormack nodded. "I see no reason why that can't be done. It would be rather close to the Mayo Clinic, then, wouldn't it?"

"And one other thing," Petty said.

"What is it?"

He pointed at Don. "I want this man—Senator Buford's dear friend—to personally head up the space station operation."

Don felt his incipient ulcer stab him as McCormack's face clouded over.

"Mr. Arnold is program manager for the space station program already," McCormack said, "and also serves as liaison to the advance shuttle program office."

"I know that," Petty snapped. "But I want him *up there,* in the space station, with the first permanent crew."

Don stared at the Senator. "Why...?"

Petty gave him a smirk. "You think living up in space is such a hot idea, let's see *you* try it!"

Senator Buford's intensive care bed looked more like a spacecraft command module than a hospital room. Electronic consoles surrounded the bed, monitoring the dying old man. Oscilloscope traces wriggled fitfully; lights blinked in rhythm to his sinking heart rate; tubes of nutrients and fresh blood fed into his arteries.

Don had to lean closer to the old man's toothless sunken mouth to hear him wheeze:

" 'Preciate your comin' to see me...got no family left, y'know." Don nodded and said nothing.

"Looks like I cain't hold out much longer," the Senator whispered. "How's the space station comin' along?"

"We've got Petty behind it," Don answered. "For a price."

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Buford smiled wanly. "Good. Good. You'll get th' whole Senate behind you. They're all gettin' older. They'll all want to go...up there."

"I'm only sorry that we're not ready to take you."

Cackling thinly, Buford said, "But I'm goin'! Ah made all the arrangements. They're gonna freeze me soon's I'm clinically dead. And then I'm gonna be sent up to your space station. I'll stay froze until the science fellas figure out how to cure this cancer I got. Then they'll thaw me out and I'll live in orbit. I'll outlive all o' you!" He laughed again.

"I hope you do," Don said softly. "You deserve to."

"Only trouble is, once I'm froze I won't need that advanced shuttle to boost me into orbit. Coulda saved th' taxpayers all that money if I'd known. I can ride the regular shuttle, once I'm dipped in that liquid nitrogen stuff."

He was still cackling to himself as Don tiptoed out of his room.

"I'm coming home, honey! For once, I'll be home in time for the twins' birthday."

Don was floating easily in his "office": a semi-circular desk welded into a bulkhead in the zero-gee section of the space station. There was no need for chairs, a few looped straps sufficed to keep one from drifting too far from one's work.

Don took a good look at his wife's face as it appeared in the telephone screen of his desk. Her mouth was a thin tight line. There were crow's feet at the corners of her eyes. Her hair was totally gray.

"What happened to your hair?" he asked. "It wasn't like that the last time we talked, was it?"

"I've been dyeing it for years and *you* never noticed," Judith said, her voice harsh, strained. "The style is gray this year...now I dye it so it's all gray."

"That's the style?" Don glanced at his own reflection in the darkened window above his desk. His hair was still dark and thick.

"How would you know anything about fashion?" Judith snipped. "Living up in that tin can in the sky."

"But I'm coming home early this year," Don said. "Things are going well enough so I can get away a whole month earlier than I thought. I'll be there in time for the twins' birthday."

"Don't bother," Judith said.

"What? But the kids..."

"The kids are nineteen and they don't want their Mommy and Daddy embarrassing them, *especially* on their birthday. The want to be with their friends, out on the farm."

"Farm?"

"In Utah. They've joined the Church of the Latter Day Saints."

"Mormons? Our kids?"

"Yes."

Don felt confused, almost scared. "I've got to talk to them. They're too young to..."

But Judith was shaking her gray head. "They won't be here to talk with. And neither will I."

He felt it like a body blow as he

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hung there weightlessly, defenselessly, staring into the screen.

"I'm getting a divorce, Don," Judith said. "You're not a husband to me. Not two months out of every twelve. That's not marriage."

"But I *asked* you to come up here with me!"

"I've been living with Jack Hardesty the past six months," she said, almost tonelessly, it was so matter-of-fact. "He's asked me to marry him. That's what I'm going to do."

"Jack Hardesty? Jack?"

"You can live up there and float around forever," Judith said. "I'm going to get what happiness I can while I'm still young enough to enjoy the time I have left."

"Judy, you don't understand..."

But he was talking to a blank screen.

Don had to return to Earth for the official opening ceremonies of Space Station Alpha. It was a tremendous international media event, with special ceremonies in Washington, Cape Canaveral, Houston, and the new life-extension medical center in Senator Petty's home state.

It was at the medical center ceremonies that Petty pulled Don aside and walked him briskly, urgently, into an immaculate, new, unused men's room.

Leaning on the rim of a sparkling stainless steel sink, Petty gave Don a nervous little half smile.

"Well, you got what you wanted," the Senator said. "How do you feel about it?" He drummed his fingers.

Don shrugged. "Kind of numb, I guess. After all these years, it's hard to realize that the job is done."

"Cost a whale of a lot of taxpayers' money," Petty said.

Gesturing at the lavish toilet facility, Don riposted, "You didn't pinch any pennies here, I noticed."

Petty laughed, almost like a little boy caught doing something naughty. "Home-state contractors. You know how it is."

"Sure."

"I guess you'll want to start living here on the ground full-time again," Petty said.

Don glared at him. "Oh? Am I allowed to? Is our deal completed?"

With an apologetic spread of his hands, Senator Petty said, "Look, I admit that it was a spiteful thing for me to do..."

"It wrecked my marriage. My kids are total strangers to me now. I don't even have any friends down here anymore."

"I'm sorry."

"Stuff it."

"Listen..." The Senator licked his thin lips. "I...I've been thinking...maybe I won't run for reelection next time around. Maybe ...maybe I'll come up and see what it's like living up there for a while."

Don stared at him for a long, hard moment. And saw that there was a single light brown spot about the size of a dime on the back of the Senator's hand.

"You actually want to live up there,

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a calendar of upcoming events

log

3-8 January
AAAS Annual National Meeting at San Francisco, Calif. Info: AAAS Meetings Office, 1776 Massachusetts Ave NW, Washington DC 20036.

4-6 January
CHATTACON 5 (Tennessee area SF conference) at Sheraton Downtown Hotel, Chattanooga, Tenn. Guest of Honor—Joan D. Vinge, MC—Wilson "Bob" Tucker. Registration $7 until 30 September 1979. Banquet $10. Dealer room tables $10 each. Info: Chattacon, P. O. Box 21173, Chattanooga TN 37421.

11-13 January
HEXACON TWO (Central Pennsylvania SF Conference) at Host Town, Lancaster, Penna. Guest of Honor—Donald R. Bensen. Registration $5 in advance, $7 at the door. Info: Bruce and Flo Newrock, Box 7?? A R.D. 2, Flemington NJ 08822.

18-20 January
CONFUSION 6 and/or 7 (Michigan regional SF conference) at Plymouth Hilton, Plymouth, Mich. Guest of Honor—Stan Schmidt, Fan Guest of Honor—Elliot Kay Shorter, Toastmaster—Rusty Hevelin. Registration $6 until 1 January 1980, $10 thereafter and at the door. Art show and auctions, 24-hour film program, masquerade, hucksters. Info: Larry Tucker, 2818 Whitewood, Ann Arbor MI 48104.

1 May
Deadline for entries in the Science Fiction and Fantasy Art Show (sponsored by the West Coast Comic Club) at the Mall of Orange, 2200 N. Tustin Ave, Orange, Calif. Info: 420 West 4th St., San Dimas CA 91773.

29 August-1 September 1980
NOREASCON TWO (38th World Science Fiction Convention) at Sheraton-Boston Hotel and Hynes Civic Auditorium, Boston, Masstts. Guests of Honor—Kate Wilhelm and Damon Knight, Fan Guest of Honor—Bruce Pelz, Toastmaster—Bob Silverberg. Registration—$30 until 1 July 1980, non-attending membership $8 at all times. This is the SF universe's annual get-together. Professionals and readers from all over the world will be in attendance. Talks, panels, films, fancy dress competition, the works. Join now and get to nominate and vote for the Hugo awards and the John W. Campbell Award for Best New Writer. Info: Noreascon 2, P. O. Box 46, MIT Branch Post Office, Cambridge MA 02139.

ANTHONY LEWIS

*Items for the Calendar should be sent to the Editorial Offices, **four months** in advance of the issue in which you want the item to appear.*

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in the space station?"

Petty tried to make a nonchalant shrug. "I've been thinking about it."

"Afraid of old age?" Don asked coldly. "Or is it something more specific?"

Petty's face went gray. "Heart," he said. "The doctors tell me I'll be in real trouble in another few years. Thanks to the technology you guys have developed, they can spot it coming that far in advance now."

Don wanted to laugh. Instead, he said, "If that's the case, you'd better spend your last year or two in the Senate pushing through enough funding to enlarge the living quarters in the space station."

Petty nodded. Grimly.

"And you should introduce a resolution," Don added, "to give the station an official name: the Senator Robert E. Buford Space Center."

"Now that's too much!"

Don grinned at him. "Tell it to your doctors."

There was no reason for him to stay on Earth. Too many memories. Too few friends. He felt better in orbit. Even in the living sections of the Buford Space Center, where the spin-induced gee forces were close to Earth-normal gravity, Don felt more alive and happier. His friends were there, and so was his work.

Don had been wrong to think that his job was finished once the space station was officially opened. In reality, his work had merely begun.

A year after the station was officially opened, von Kluge came aboard as a retiree. His secretary, Alma Tucker, still lithe and wonderful despite the added years, came up to work for Don. They were married a year later. Among the witnesses was Senator Petty, the latest permanent arrival.

The Buford Space Center grew and grew and grew. Its official name was forgotten after a few decades. It was known everywhere as Sky City.

Sky City became the commercial hub of the thriving space industries that reached out across the solar system. Sky City's biomedical labs became system-famous as they took the lead in producing cures for the various genetic diseases known collectively as cancer.

Ex-Senator Petty organized the first zero-gee Olympics, and participated personally in the Sky City-to-Tranquility Base yacht race.

Von Kluge, restless with retirement, became an industrial magnate and acquired huge holdings in the asteroid belt: a Junker land baron at last.

Alma Tucker Arnold became a mother—and a prominent low-gravity ballerina.

Don stayed in administration and eventually became the first Mayor of Sky City. The election was held on his ninety-ninth birthday, and he celebrated it by leading a bicycle race all around the City's perimeter.

The next morning the First official act as Mayor was to order the thawing of Senator Buford. The two of them spent their declining centuries in fast friendship. ■

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the analytical laboratory

1938-1976

BY WILLIAM SIMS BAINBRIDGE

From March 1938 through October 1976, stories in every issue of Astounding Science Fiction, renamed Analog in 1960, were rated in a readers' poll called the Analytical Laboratory. An incredible amount of fascinating literary data lies buried in the 464 "Labs" that were published, covering twenty-five hundred fiction items. Half of these were short stories, and a third were novelettes. The remainder consisted of the most influential pieces of fiction, 70 "short novels" published whole in single issues, and 133 serialized novels published in a total of 370 installments. Since each installment was rated separately by readers, we will count them separately here. Included in these large numbers are many of the most popular works of science fiction ever written. This article will show how we can reanalyze the Labs to answer a variety of questions: Which authors were the most popular? Does the length of a story affect its popularity? Was the Laboratory biased against authors of some kinds of science fiction? Can we chart the ups and downs in an author's career?

For the first two and a half years, the Lab merely listed the stories in order, from the most popular in first place down to those near the bottom. The Lab for October 1940 introduced a more precise system. Votes for each story were tallied. Each first-place vote gave the story one point; second place gave two points; third place three points, and so on. The total number of points for each story was added, then divided by the number of people voting on that story. For the first fifteen years, the Lab was just used to express reader opinions and guide the editor in deciding which authors to emphasize, but from 1953 onward, the authors that came out on top were given a cash bonus.

The impulse to analyze science fiction scientifically has gripped many readers over the years. For example, John A. Leiter, an Oregon attorney, quantitatively expressed his personal opinions about authors and their fiction, in a letter published in the August 1933 issue of *Wonder Stories.* Leiter rated stories on a scale of 1 to 10, and came to the grand conclusion that *Wonder Stories* averaged 27 percent superior to its rival, *Amazing Stories.*

When John W. Campbell, Jr. became editor of Astounding in 1937, this magazine had already taken a lead in the field, but Campbell wanted to

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improve both its quality and popularity. One of his first decisions was to restore Brass Tacks, a general letter department, in the November 1937 issue. Six months later he wrote, "A magazine is not an autocracy, as readers tend to believe, ruled arbitrarily by an editor's opinions. It is a democracy by the readers' votes, the editor serving as election board official. The authors are the candidates, their style and stories their platform." (April 1938:125) The first Analytical Laboratory was published in the following issue, rating the top six stories that had appeared in March. Campbell explained that the Lab was a supplement to Brass Tacks: "Since we can't print all the letters—or even a large fraction of them—we are going to print the results." (May 1938:160)

Other editors eventually copied Campbell's Lab. From its very beginning in 1946, the British magazine *New Worlds* has carried a readers' poll called The Literary Line-Up. In the 1950s Robert A. W. Lowndes published a poll called The Reckoning in his magazines *Dynamic Science Fiction, Future Science Fiction, The Original Science Fiction Stories,* and *Science Fiction Quarterly.*

Two readers, Walter A. Carrithers and Dennis Donahue, have attempted to expand the scope of the Analytical Laboratory. In the November 1943 issue of Astounding, Carrithers reported his analysis of 1360 Brass Tacks letters published over the previous ten years. He counted one point for each favorable mention of a story, 2.5 points for an "all time choice" rating in one of the letters, and minus one point for every disparaging opinion. Jack Williamson's novel, *The Legion of Space,* won first place for the decade, and E. E. "Doc" Smith's *The Skylark of Valeron* came in second.

Donahue's report, published in the December 1972 letter column, anticipates the analysis carried out in this article. He calculated average point scores for an accidental sample of stories by ten authors. First place went to Lloyd Biggle, Jr. on the basis of only three stories, and Donahue's analysis was not systematic enough to give reliable results. It is not good enough merely to record Lab scores and rank them or average them to get an overall rating of the authors. Before I can report my own findings, I must explain the nature of the Analytical Laboratory and show how it can be analyzed correctly.

Analyzing the Laboratory

Let us start with a specific example. I have chosen the Lab for a very special issue, November 1949. Filled with stories by the greatest authors, this famous issue is the hero of its own science fiction story: The November *1948* issue contained a letter from Richard A. Hoen rating the stories in the November *1949* issue. There are two possible explanations for this remarkable Brass Tack. Either Hoen's letter was delivered to 1948 by time machine, or Campbell puckishly contrived to bring Hoen's fantasy to

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life. In either case, the November 1949 issue was duly rated by other readers, resulting in the Analytical Laboratory given in Figure 1.

Five stories are listed in order, from the most popular to the least. In first place is installment one of *Gulf* by Robert A. Heinlein, with a point score of 1.38. Let's review how Campbell calculated this. If every reader had put Heinlein in first place, his point score would have been 1.00. Perhaps only eight people voted, five giving Heinlein first place, and three giving him second. Then Campbell would have figured the average score as follows:

$$\frac{(5 \times 1) + (3 \times 2)}{5 + 3} = 1.38$$

Or, perhaps the vote was five hundred for first place and two hundred for second. The result would be the same. It is possible that some readers put Heinlein in third place. We do not know what the actual numbers were, but we can assume they were large.

Both in the *place* listings and in the *point* scores, as in the game of golf, a low number is a good rating, while a high number is bad. This seems simple enough. But there are at least four reasons why we cannot blithely add and divide the place and point scores in an overall analysis of the authors and their twenty-five hundred stories.

The first problem is that the Analytical Laboratory frequently fails to report votes on the least popular stories. In addition to the five items listed in Figure 1, the November 1949 issue also contained "Finished," a short story by L. Sprague de Camp. We can easily add it to the list, putting it in sixth *place,* but there is no way to know how many *points* it received.

The second problem was mentioned by Campbell: "Not every reader letter casts votes on all the stories; thus the total number of votes cast for a particular story may not equal the total number of ballot letters." (October 1943:29) Probably, people will tend to skip stories they dislike. This means that the point scores for the least popular stories will be lower (better) than they deserve to be.

The third problem is that Campbell used an odd convention for expressing tie votes. For example, A. E. van Vogt won first place in the December 1948 issue, while Poul Anderson and Eric Frank Russell tied for second. In the Lab, Campbell gave second place to both Anderson and Russell, and

Place	*Story*	*Author*	*Points*
1	Gulf (Part I)	Robert A. Heinlein	1.38
2	And Now You Don't (Part II)	Isaac Asimov	2.33
3	What Dead Men Tell	Theodore Sturgeon	3.00
4	Final Command	A.E. van Vogt	4.09
5	Over the Top	Lester del Rey	4.90

Figure 1: The Analytical Laboratory for November 1949. This poll rates one of the most famous issues of Analog's predecessor, Astounding Science Fiction.

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awarded third place to a story by H. B. Fyfe. More properly, Fyfe should be in fourth place, since three stories got better ratings than his. Since Anderson and Russell were battling for second and third place, we should put each of them in "2.5" place. If many readers expressed tie scores the way Campbell did, then again some lower-rated stories would wind up with incorrectly good scores.

The fourth and most important problem comes from the fact that different issues contained different numbers of stories. Campbell recognized that this fact made it very difficult to compare from one issue to another. One time he commented, "The June issue carried seven stories besides the article; this means that point-score votes ranged from one to seven—and made point scores tend to run high. That's somewhat unfair, in a way—a third-place story or fourth-place story in such an issue has met and surpassed more competition, yet gets a tougher point score than the rearguard item in a five-story issue. Some day all things will be perfect—and a completely fair system of reporting may be worked out." (September 1943:48) This article will use specially-designed correction formulas to defeat these four problems and make it possible to translate all scores to a single, uniform scale.

The *place* orderings, which exist for all 464 issues, can be converted to a uniform scale with a simple and mathematically sound formula. This was derived from probability logic by Toshio Yamagishi, a graduate student in my sociology department. In outline, the thinking is as follows. Suppose all twenty-five hundred stories were ranked from best to worst, in a single huge Lab. Now let Chance play the role of editor, selecting stories at random to fill the 464 issues. Finally, assume that stories within each issue were rated by a regular Lab, so we know which one is the most popular, which is second in the issue, and so on. Mr. Yamagishi pointed out that we can derive a statistical formula that lets us predict the probability that a story in a given place in an issue of given size will come from any given level in the ranking of 2500. From this rather complex mathematical expression, he derived Formula I, a very simple equation that gives the expected rank of a story. While the above logic is absurd if applied to any one actual issue, it does describe adequately the average of any randomly chosen group of issues.

$$\text{FORMULA I:} \qquad X = N \frac{P}{m + 1}$$

X is the desired result, the story's standardized rank in a scale that can be used to compare from one issue to another. The letter P stands for the *place* the story achieved in the Lab for its issue, while m is the total number of stories in that issue, whether listed in the Lab or not. N stands for the number of steps in the standardized ranking scale, assumed to be a large number. In this article, I have let N equal 1000. Formula I divides the entire range of the ranking scale into

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equal parts, their number depending on how many stories appeared in the issue. November 1949 contained six stories, so Formula I divides the thousand ranking steps into sevenths. Heinlein's first-place story gets an estimated rank of 143, because 1000 X 1/7 = 143. Asimov's story, in second place, receives 286, and the others follow in order, 429, 571, 714, and 857.

What would have happened if de Camp's story had not been published, if the issue had contained only five stories? Then the thousand ranking steps would have been divided into sixths, and Heinlein's story would have received an estimated rank of 167. Like the Analytical Laboratory place and point scores, this new scale of 1000 assigns a low number to a popular story, and a high number to an unpopular one. Thus, Heinlein's story gets a better rating in an issue of six stories than in an issue of five stories. This makes perfect sense—presumably the competition is tougher the more other stories there are in an issue. Formula I gives the following estimated ranks out of 1000 to the first-place stories in issues of from three to ten stories: 250, 200, 167, 143, 125, 111, 100, 91.

Probability logic could be applied to the *point* scores as well as to the *place* listings, deriving expected point distributions for each place in each sized issue. This would involve many tedious estimation procedures based precariously on small samples of data. I have chosen to use a cruder but still serviceable method of approximation. I start with a basic observation: The average point score for a given place in all issues of a given size is equivalent to the place number itself. For example, it turns out that the average point score for first-place items in the 82 four-item issues is 1.64. Formula I tells us that first place in a four-item issue earns an estimated rank of 200. Therefore, we can let a point score of 1.64 equal an estimated rank of 200. The average for second place is 2.24, so we let this equal 400, and so on.

This is fine for those rare stories that have exactly average scores, but what about all the others? Here I make a slightly wobbly but cogent assumption: Scores in-between can be estimated using a simple mathematical function derived from the distribution of average scores. I was prepared to try various logarithmic curves, but I was pleasantly surprised to discover that straight lines fit the data quite well. The approximation was carried out separately for each different number of stories in an issue, and involved deriving equations for what are called *regression lines* (or *trend lines*). The overall error, the amount to which the straight lines missed the average scores, was only about 1.5 percent. Formula II gives the equation for converting any point score to an estimated rank in a scale with 1000 steps.

FORMULA II: $$X = \frac{S - a}{b}$$

X is the desired estimated rank, while S is the story's point score, and a

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Number of Items in the Issue	Number of Such Issues	Constants: a	b
3	1	1.1	0.002
4	82	1.15	0.00265
5	202	1.33	0.00324
6	114	1.62	0.00356
7	29	1.48	0.00484
8	4	2.2	0.0033
9	1	1.7	0.005

Figure 2: Constants for Use in Formula II. This table lets the reader do his own Lab research using both our conversion formulas. To convert the point score of any story to our 1000-step scale, simply plug the score and the appropriate constants from this table into Formula II.

and b are constants derived from my regression analysis for each size of issue. Figure 2 gives the list of constants, so anyone may use this formula in their own Lab research. Of course, there are so few issues with 3, 8, or 9 stories that the estimates for these cases will be especially crude. Because real issues vary greatly in quality, Formula II will sometimes give a result less than zero or greater than a thousand. But when stories with such extreme estimated ranks are averaged in with others, these wild variations tend to wash out. Formula II is compatible with Formula I, so when a Lab fails to give a point score to a story, we can use the value from Formula I instead.

November 1949 was indeed an unusual issue. Despite the heavy competition, Heinlein's 1.38 score was much better than average, and it translated through Formula II to an estimated rank of *minus* 67. Asimov gets an even 200, somewhat better than the 286 estimated by Formula I. The other scores go: Sturgeon = 388, van Vogt = 694, and del Rey = 921. If my approximation procedures are any good, Formula II gives a more precise estimate than Formula I, because it makes use of the much greater information carried by the point scores, compared with the rough place listings.

Honor Roll of Authors

Using both Formula I and Formula II, I calculated the average estimated rank of all fifty-three authors who had published ten or more stories in the 464 issues covered by the Lab. Figure 3 lists these writers, along with the number of stories, their average year of appearance, the average estimated rank based on the *place* listings, and the average estimated rank based on the *point* scores. As in a regular Lab, the authors are listed in terms of their point scores, from the most popular to the least. Two things should be mentioned about these estimates. First, the two estimates tend to agree with each other, although some differences result from the greater sensitivity of

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Formula II. Second, the average for all stories over the thirty-eight years is 500, according to either formula, so all the authors below Silverberg are *below average*.

A glance at this big table shows that Robert A. Heinlein, "Dean of Science Fiction Writers," is in second place. What author could possibly be more popular than Heinlein? The answer is: Heinlein himself! "Anson MacDonald" was one of Heinlein's pen names. There are other pen names on the list. "David Gordon" is a pen name of Randall Garrett. "Lawrence O'Donnell" and "Lewis Padgett" are both pseudonyms for the collaboration of Henry Kuttner and C.L. Moore. "Clement," "Anvil," and "Correy" are also pen names, but their owners are not represented by other names on the list. There are several surprises in Figure 3, but I will leave these discoveries to the reader. There is much to contemplate and debate in the table, but I will turn to the question of how mere length influences popularity of works of fiction.

The Long and the Short of Science Fiction

Over the years, Campbell mentioned several factors that might influence the popularity of a story, and once suggested that the second episode of a serial might have suffered because readers forgot characters and plot details over the month since the first episode. (June 1955:118) This suggests the possibility that later installments are less popular in general than the first installments. Figure 4 graphs data that support this idea. It shows the average popularity of serial installments, including the one-installment "short novels." Frank Herbert's novel, *The Prophet of Dune,* was the only work that ran for five installments. I dropped the middle episode, and included this long novel in with the 19 four-installment novels. Sixty-three serials had three installments, fifty had two, and there were seventy short novels. The graph shows that later installments tended to be less popular than first episodes. Also, serials of three or four episodes, really full-length novels, were of equal popularity, while two episode novels and short novels were significantly less popular. This suggests that popularity depends on the length of the fiction, as well as on the skill of the author.

Campbell commented on the length factor several times. "One of the problems inherent in science fiction is that each story actually is a brief glimpse of an alien world-scene. The longer the story, the more chance the author has to give a feel of reality—a texture of living fabric—to his world-picture. Result: a longer story, all things—and authors!—being equal, will have more satisfying effect for the reader." (June 1956:72) Of course, it may simply be that readers best recall those stories that took longest to read, subconsciously multiplying the enjoyment experienced per page times the number of pages to arrive at a total impression. Perhaps this is partly true, but Figure 4 shows something more subtle. First installments of two-

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Figure 3: Honor Roll of Fifty-Three Authors. This table gives the average estimated popularity of every author who published ten or more stories ranked by the Analytical Laboratory. The best-loved authors are at the top.

Author	Number of Fiction Items	Average Date of Publication	Average Estimated Rank: "Place" Listings	"Points" Scores
1. Anson MacDonald	10	1941	210	98
2. Robert A. Heinlein	25	1947	228	145
3. E.E. "Doc" Smith	13	1944	244	190
4. Jerry Pournelle	11	1973	280	265
5. A.E. van Vogt	59	1944	348	298
6. Harry Harrison	32	1966	321	316
7. Lawrence O'Donnell	11	1947	330	323
8. Frank Herbert	28	1963	381	329
9. Poul Anderson	67	1960	348	332
10. Hal Clement	29	1953	315	340
11. Jack Williamson	19	1944	348	343
12. Clifford D. Simak	39	1949	356	350
13. Isaac Asimov	45	1950	391	351
14. H. Beam Piper	20	1957	318	351
15. Stanley Schmidt	12	1972	363	362
16. David Gordon	11	1959	372	377
17. Raymond F. Jones	31	1949	390	378
18. James Blish	12	1956	380	386
19. Gordon R. Dickson	43	1965	414	387
20. James H. Schmitz	39	1964	380	390
21. John T. Phillifent	11	1968	410	391
22. Eric Frank Russell	45	1951	403	397
23. Randall Garrett	32	1961	372	405

episode stories and short novels rank much lower than first installments of three-episode and four-episode novels. When the readers rate these opening installments, they have not yet read the concluding parts of each work. Apparently, long fiction has a special quality that emerges even in the first few chapters. When an author writes a long novel he probably invests more effort in planning and characterization, so that even the first part of a long novel conveys more vivid images than an equally long segment of a shorter work.

Another time, Campbell explained: "Generally, the longer a story is, the more chance the author has to work out his background ideas, characters, and plotting. Serials generally take first place, primarily because the author can do a better job. Unlike here-and-now-stories, science fiction must describe even the common things of life—life in the story environment. More space gives more chance for that. The result is that there are very few long-remembered, "classic" short stories, a few novelettes, but many much-mentioned seri-

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24	Walter M. Miller, Jr.	10	1952	408	410
25	Mack Reynolds	48	1964	410	428
26	Murray Leinster	40	1953	419	432
27	Lester del Rey	24	1944	442	433
28	Lewis Padgett	35	1945	437	434
29	Fritz Leiber	14	1946	452	439
30	L. Ron Hubbard	23	1944	443	441
31	E.B. Cole	15	1957	428	456
32	Theodore Sturgeon	23	1945	423	457
33	L. Sprague de Camp	27	1946	456	460
34	Katherine MacLean	10	1959	427	472
35	Robert Silverberg	15	1961	472	480
36	Malcolm Jameson	28	1942	520	510
37	George O. Smith	34	1949	529	520
38	Christopher Anvil	73	1964	556	542
39	Nathan Schachner	16	1939	548	564
40	Ross Rocklynne	16	1942	555	579
41	Theodore L. Thomas	10	1962	619	595
42	Robert Chilson	12	1970	583	620
43	Algis Budrys	22	1957	640	636
44	Jack Wodhams	24	1969	610	644
45	A. Bertram Chandler	19	1952	608	647
46	Walt & Leigh Richmond	11	1965	634	667
47	Lee Correy	10	1956	710	669
48	H.B. Fyfe	20	1953	657	681
49	P. Schuyler Miller	12	1942	717	683
50	Harry Walton	11	1942	742	723
51	W. Macfarlane	14	1967	725	732
52	Lawrence A. Perkins	11	1969	725	747
53	Frank Belknap Long	11	1945	829	805

als (July 1946:122) To test this idea on all kinds of fiction, I tabulated place distributions for all fiction published in the 187 five-story issues that contained no Lab ties. Figure 5 gives the results.

The pattern is quite regular. Serials beat out short novels which surpass novelettes which win over short stories. Indeed, the short stories are crammed into the last three places. Figure 5 shows that the length factor is really very powerful. Since length of fiction makes such a difference, we should reconsider Figure 3 and its estimates of popularity for the authors. Some authors may write huge, dull novels that get good ratings simply because they are big and, therefore, memorable. Other authors may create marvelous jewels of short stories, which have less impact on the swift-eyed readers. Figure 3 is entirely valid, so long as we understand that it measures the over-all impact of each author rather than the quality of writing page-for-page. We need an alternative estimate of popularity that removes the powerful influence of length of fiction.

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New Analysis of the Authors

To arrive at a new, length-corrected measure of popularity, I sorted all twenty-five hundred pieces of fiction into the four basic length categories: serials, short novels, novelettes, and short stories. I then arranged the items in each group in order of the estimated rank based on point scores. This gave me the equivalent of four huge Labs. I applied Formula I, calculating new estimated ranks on the 1000-step scale. Since these rankings were calculated for each type of fiction separately, the effect of length of fiction was largely eliminated. The number of items in each of the four sets ranged from 70 to over 1200, so Formula I gave much more precise estimates than when used with regular Labs. Figure 6 is a map of these new popularity ratings.

The vertical dimension of Figure 6 puts the best-liked authors at the top, and the least-liked at the bottom. Authors on the right side wrote a high proportion of short fiction, while authors on the left specialized in long works. Open circles represent writers who lost ground from the ranking in Figure 3, or barely held their ground. Solid circles are authors that rose five or more places in the ranking. As expected, the authors that rose significantly in the new ranking tended to write a good deal of short fiction.

An unfortunate effect of thirty-eight years of Analytical Laboratories may have been to downgrade short stories in favor of vast epics, thereby slighting the genius of some very fine authors. Close examination of Figure 6 will help redress the balance. The most spectacular rise was 27 places, achieved by Malcolm Jameson who went from 36th to 9th. Lester del Rey zoomed up 21 places, while other big gainers were Gordon, Russell, Walter Miller, Leiber, Leinster, Padgett, MacLean, Sturgeon, Silverberg, Anvil, and Correy. Each of them gained ten or more places in the ranking. Four authors dropped more than twenty places: "Doc" Smith, Harrison, Clement, and Piper. Despite the fact that he seldom wrote short stories, MacDonald-Heinlein did not budge from first-and-second place.

Our final use of Lab statistics will be to chart the changing popularity of three authors throughout their Astounding-Analog careers. I have chosen A. E. van Vogt, Poul Anderson, and Isaac Asimov because they are the best known of the most prolific writers. I arranged each man's stories from earliest to latest so we could see the trends over time. If I just graphed the raw data, we would have a bewildering tangle of zig-zags, so I did two things to smoothe the curves out. First, I used the length-corrected popularity estimates on which Figure 6 was based. If we did not correct for length of fiction, the line on the graph would hop up and down wildly as each author switched back and forth from long novels to short stories. Second, I further damped out short-term variations by calculating seven-point moving averages. A "moving" average

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does just what the name implies—it moves. Each point does not really represent the popularity of a single story, but of that story averaged in with the three that came before it and the three that come after it. Thus, the height of the line at X = 4 is the average score for stories 1 through 7. The height at X = 5 is the average for stories 2 through 8, and the height at X = 6 is the average for stories 3 through 9. Because we need seven stories for each average, we can't calculate values for the first three and last three stories by each author. Figure 7 shows the careers of van Vogt, Anderson, and Asimov.

We can read these lines just like the ones on stockbrokers' graphs indicating the ups and downs in the stock market. Van Vogt's graph shows a tragic pattern. He begins very high, and rises slowly to a marvelous crest that begins to turn downward at the end of 1943. A gradual decline steepens into a precipitous fall, halted only briefly, that drops into a chasm in 1946. A recovery over the next two years restores only a third of the original loss, and van Vogt fades until his last story in 1950.

Anderson's pattern is quite different. It depicts a stalwart writer ready to battle back from adversity. He starts in the late 1940s just at the 500 average, and quickly rises to the 300 level. He holds a plateau, until suffering a terrible slump around 1958. He struggles back up to his former popularity, then slips back to begin a steady rise that continues until the end of the period covered by the Lab.

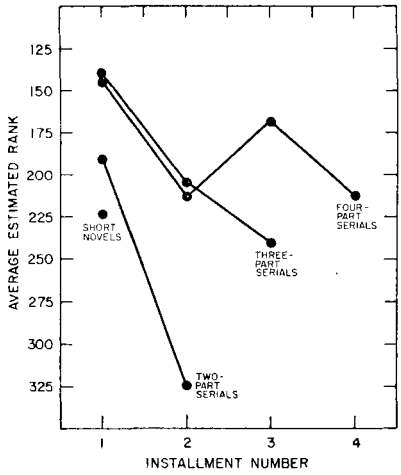

Figure 4: Popularity of Serial Installments. The first installment of a serial tends to be more popular than the second, third, or fourth installment. Perhaps, readers forget plot and character details over the month's gap between episodes, and others may find it confusing to begin reading in the middle of a story. This chart also shows that full-size novels of three or four installments are more popular than shorter novels, even in the first installment.

We see yet a third pattern in Asimov's graph. He starts at a very high level around the year 1940, drops quickly, then recovers to the 200 level. A steady decline sets in, taking him down below 600 in 1954. His final recovery is not as simple as it appears on the graph. After publishing in Astounding-Analog quite regularly, Asimov was completely absent from its pages from 1956 to 1968, and only his last two stories, in 1972 and 1976, received really good ratings. The overall trend of Asimov's line is

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Place	Serial Installments	Short Novels	Novelettes	Short Stories
1	70%	51%	20%	2%
2	18%	40%	42%	5%
3	10%	9%	24%	22%
4	2%	0%	11%	33%
5	0%	0%	3%	38%
Total	100%	100%	100%	100%
Number of Items	145	35	294	461

Figure 5: Percentage of Four Kinds of Fiction Achieving Each "Place" in 187 Five-Story Issues. Long fiction has a tremendous advantage over short fiction. This table summarizes Lab ratings of 935 stories and serial installments, showing that the shortest works almost never achieved high popularity.

downward. Just as van Vogt vanished from Astounding after years of decline, so did Asimov, devoting himself instead to a splendid career of popular science fact writing. We cannot say for sure that Asimov was driven out of science fiction by a declining popularity, and only he can tell us if he experienced his career in this way. In fact, it takes a close reading of the Labs to discern the negative trend. The estimates reflected in Figure 3, which have not been adjusted for length of fiction, do not show it, but display a very shallow rise. The reason is that Asimov shifted from short to long fiction over his career. Sixty-four percent of his first 22 Astounding pieces were short stories, but only 18 percent of the last 22. While Asimov's short stories were rated higher than most other authors' shortest works, his long fiction was rated near the average for novels and novelettes. One of the most remarkable facts about Asimov's career is that he has established himself as possibly the most famous contemporary science fiction writer, despite the fact that most of his fiction was written decades ago and did not receive consistently favorable ratings.

Conclusion

This article has shown how data from thirty-eight years of Analytical Laboratories can be standardized and used to answer many questions about the popularity of authors and types of fiction. Despite our many findings, we have not exhausted this vast store of information. Far from it! Many projects remain to be done, several of them combining the Lab data with other facts and judgments. For example, one could read the more than twelve hundred short stories in the collection, coding each of them according to its style and content. Then we could chart the changing popularities of the different categories. Are stories about psi and ESP really popular in

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the fifties, or are they common only because John Campbell encouraged them? Do robots rise and fall over the years, or are they perennial favorites? Are there trends in the popularity of pessimistic stories, or triumphant stories, or politically conservative stories, or erotically liberal stories, or indescribable stories? The opportunities are not endless, but they can keep us busy for a good, long time. ■

Note

Statistically-minded readers will recognize that the Analytical Laboratories, and several portions of this article, treat ordinal data as if they were interval data. This is most obvious when we calculate averages from rank-order data. Since all our information comes from averages calculated in the Labs themselves, I have felt we must assume our data could be treated as if they were interval. Certainly, the presentation of our results is made much easier. But Formula I is not based on this assumption; nor is Figure 5. For a reference on some aspects of this problem see: "The Level of Measurement and 'Permissible' Statistical Analysis in Social

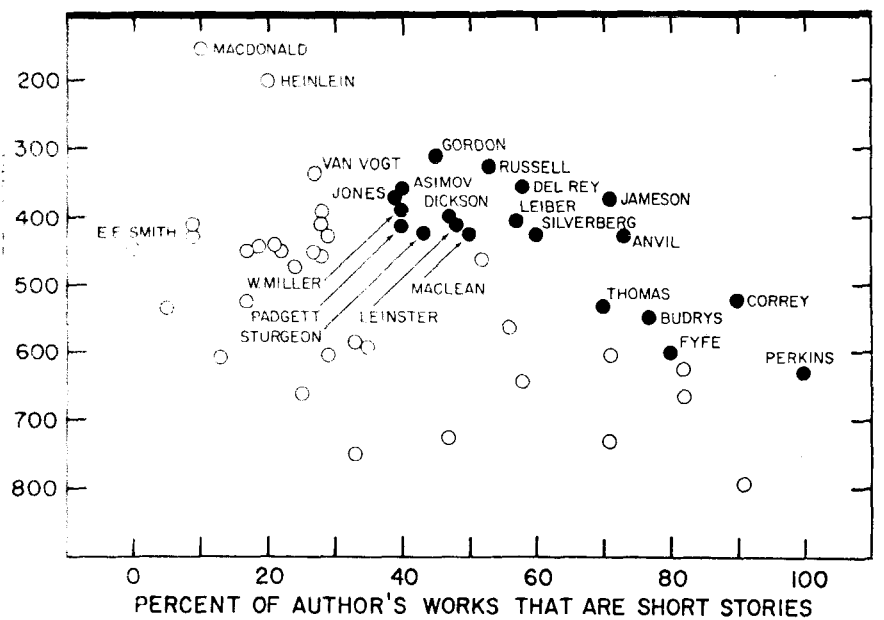

Figure 6: Popularity Map of Fifty-Three Authors, Correcting for Length of Fiction. Each circle represents one author. Open circles are authors who held their positions or even lost ground when we switched to a length-corrected measure of popularity. Solid circles represent authors that gained five or more places in the ranking.

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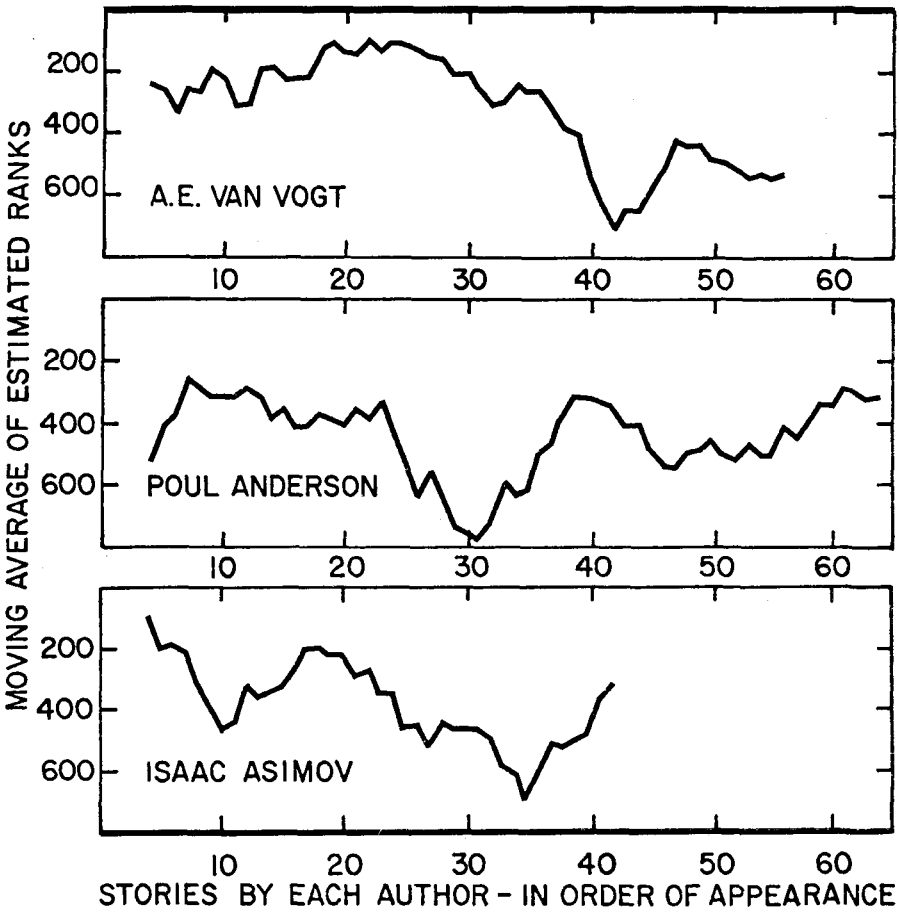

Figure 7: The Careers of van Vogt, Anderson, and Asimov. These charts are like stock market graphs, showing the ups and downs in the Astounding-Analog careers of three of the best-known and most prolific science fiction writers.

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THE MOON BELONGS TO EVERYONE

THE ALTERNATE VIEW by JERRY POURNELLE

Remember when space law was science fiction? Many years ago we nuts who liked science fiction and believed in space travel had a dream.

It was a dream shared by most scientists. We would carry no national boundaries to space. Space and the moon were and ought to be the common heritage of mankind; and space-faring man would be too mature for petty things like nationalism.

We reached the moon, and we're going to space, but things are not quite as we predicted. Far from dying away as man's capabilities increase, nationalism is still with us, stronger than ever; but the dream has not faded. It's about to become law. After twenty-two sessions of failure, the Committee on the Peaceful Uses of Outer Space has finished its work; and the draft treaty reads like a science fiction story of the forties.

In ringing terms it states that "The exploration and use of the moon shall be the province of all mankind and shall be carried out for the benefit and in the interest of all countries, irrespective of their degree of economic or scientific development. Due regard shall be paid to the interests of present and future generations as well as to the need to promote higher standards of living conditions of economic and social progress and development in accordance with the Charter of the United Nations."

Another clause declares that all provisions relating to the moon shall also apply to other celestial bodies within the solar system, and to orbits and tra-

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jectories around and to them. There are also articles prohibiting military bases on the moon; force or threats of force on the moon; and using the moon to threaten the Earth, etc.

The treaty continues through twenty-one Articles, but perhaps the most important is Article XI: "The moon and its natural resources are the common heritage of mankind.... The moon is not subject to national appropriation by any claim of sovereignty, by means or use of occupation, or by any other means....Neither the surface nor the subsurface of the moon, nor any part thereof or natural resources in place, shall become the property of any State, international intergovernmental organization, national organization or nongovernmental entity or of any natural person."

Strong and noble words indeed; the kind of treaty which, back in the earlier days of dreams of glory, seemed more impossible than space travel itself. This is the language, these are the ideals we hoped and prayed for in the forties—and it's all real. The U.N. is very likely to adopt it. The U.S. negotiators are happy with it and will recommend that the United States sign and ratify it. It could be a reality within the year.

And I fear it's a disaster.

I don't say this lightly. I grew up in the golden age of science fiction, when nearly every story asserted that science knows no boundaries; a time when nationalism had about as much scientific respectability as phrenology. Moreover, I recognize a genuine need for an international agreement governing the uses of outer space, and I can accept the principle that all mankind should benefit from space exploration *and exploitation.* But I can't swallow this treaty, and I intend to use whatever influence I have to prevent our signing it or to defeat it in the Senate if the administration does sign it. For all the noble sentiments expressed in the Lunar Treaty, its practical effect, in my judgment, will be to inhibit space activities.

The problem is simple: something that belongs to everyone can belong to no one; and that which no one owns receives very little investment.

Example: suppose that the United States decides, as I fervently hope we will, to build Solar Power Satellites. One of the most promising approaches to SPS involves extensive use of lunar materials. Let us assume, then, that we have built the construction shack in space and we're ready to open moon mines. From whom must we obtain permission?

What does "common heritage of mankind" mean?

How can you mine an area you cannot own? If a commercial firm invests in moon operations, what *do* they own, and what rights will they have? For that matter, what rights will governments have? And who would be mad enough to invest tens of billions of dollars in such an enterprise while those questions are unsettled?

As I read the treaty it seems totally to prohibit private ownership—and thus private commercial enterprises—

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everywhere in the solar system, and throws a number of barriers in the way of government exploitation of outer space resources. When I consulted legal experts (I had to; I am on the Board of the L-5 Society, and thus was required to vote on the question of what L-5's policy regarding the Lunar Treaty would be) I found a wide diversity of opinion. Some experts in international law saw the same barriers to commerce that I did. Others, equally respectable and equally experienced, not only disagree with my interpretation, but have become enthusiastic advocates of the treaty.

And this isn't all just talk. Cynics might take the view that the treaty doesn't matter; if there's money to be made in space, no one will let a silly scrap of paper stand in the way; but the cynics are wrong.

The Constitution of the United States is very specific on the matter. Treaties, once they are ratified by the Senate, become part of "the supreme law of the land," and are enforceable by our domestic courts. Now tell me that once the Lunar Treaty is part of our law there won't be plenty of lawyers who will see this treaty as a golden means of going to court to stop our "wasting all that money in outer space when there are so many problems right here on Earth." Tell me there won't be judges who'll issue injunctions.

If experts of good will cannot agree on the basic meaning of the treaty now, we will, if we adopt this thing, have given the entire space program into the tender care of the lawyers, to be decided by legal games in courts already notorious for the infinity of delays built into our "trial by combat" system of judgment.

I can't think of a better way to discourage space activity than by declaring the celestial bodies—and all useful orbits also—to be the common heritage of mankind and then writing that declaration into our domestic law. Instead of a space program we'll have endless legal battles—and if mankind ever does inherit the stars it will be only after long delays and the enrichment of lawyers. No. The proposed Lunar Treaty will, by discouraging investment in space exploitation, be detrimental to everyone—including the undeveloped nations who are sponsoring this.

And yet—we do need an international agreement, and we're going to need it fairly soon. For example: Solar Power Satellites will need Geosynchronous Earth Orbits (GEO); and GEO is a fairly limited resource. If you put nothing else in GEO but SPS you'd be unable to get more than about 3500 10 gigawatt SPS going (they're *big* and require fairly wide separations); and while that's a lot of power, it's not infinite. Moreover, there are a lot of other uses for synchronous orbits; and I for one am not willing to accept the principle of winner take all in allocation of this limited resource. As I've said before, I can accept the proposition of "common heritage of mankind." I can even

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accept the proposition that those exploiting celestial resources such as GEO, lunar minerals, asteroids, etc., should pay for the privilege; that a percentage of the profits should be distributed for the general good of humanity.

What I can't accept is that a *principle* should become a formal treaty, and thus be written into our domestic law. Investors could live with a specific tax, predictable in advance. After all, in this imperfect world, everybody has to pay taxes to someone. Moreover, those drafting an agreement specifying royalties to be paid for the privilege of exploiting celestial resources are not quite so likely to squeeze a nonexisting enterprise. If they set the rates too high, there'll be nothing to tax. Of course something specific will be much harder to draft, and less likely to win universal acceptance, than a principle...

Which is precisely my point. The Lunar Treaty does in fact postulate an "international regime" which shall have as its purpose "the orderly and safe development of the natural resources of the moon [and other celestial bodies]; the rational management of those resources; the expansion of opportunities in the use of those resources; and an equitable sharing by all States Parties [to this Treaty] in the benefits derived from those resources, whereby the interests and needs of the developing countries as well as the efforts of those countries which have contributed either directly or indirectly to the exploration of the moon [and other celestial bodies] shall be given special consideration." And if you can tell me what that *really* means, I'll give you sixpence.

They couldn't agree on what the "regime" would look like; who would run it; how it would be administered; what kind of taxes it might levy on space exploitation, or what would be done with the revenue. They did agree that one should be established someday, and that it would have absolute control over all exploitation of our part of the universe; and that anyone seeking to make a profit out of outer space will have to do so in accordance with rules to be promulgated someday by this not-yet-existent international entity.

And that is very dangerous. If the third world can't agree now, while there's no pie to divide, and thus some incentive to be lenient in the hopes of encouraging someone to go invest in space and bring home some goodies—what will things be like when big bucks are at stake? Does anyone seriously think that greed won't figure in the charter of this yet to be established international regime?

And it isn't as if there's no precedent. The high seas are also the common heritage of mankind, and look at how we've "managed" our undersea resources. *HMS Challenger* discovered metal nodules on the deep sea floor in 1873; but no one has made commercial use of this resource to this day, even though we've had the technology to do it for a long time.

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One large mining company recently wrote off an investment of over a hundred million dollars and abandoned further ocean mining research, not because of technological problems, but because mining the sea floor requires a very high front-end investment, and there is no way to own a developed area of the sea floor.

We've known for years that fertilization of the sea and placement of artificial reefs can greatly enhance the harvest of sea resources: but you can't own a chunk of sea bottom, and who will sow where everyone is allowed to reap?

Exploitation of space requires a lot higher front-end investment than sea farming and sea mining.

We've come a long way since the days of my youth. Time was that space law and the legal problems of space were a science fiction monopoly. No more. Now space law is a highly practical matter, and there's a very great deal at stake. We need space law. We need it now. But we need law, not idealistic fantasies.

The principle of a common heritage of mankind was a beautiful dream; but it's morning, and past time we turned that dream into a practical agreement we can all live with, lest the dream strangle itself and us with it. ■

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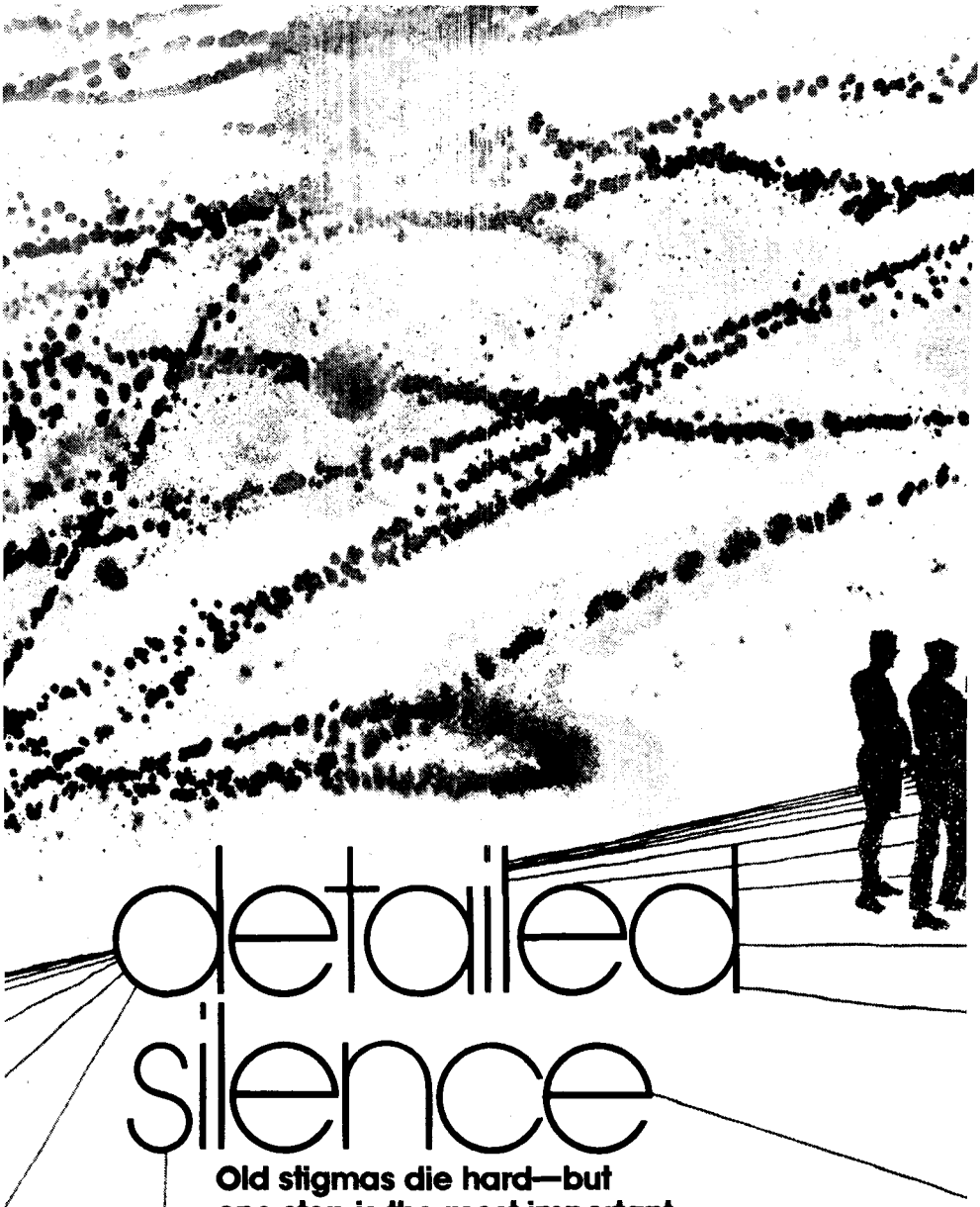

detailed silence

Old stigmas die hard—but one step is the most important in overcoming them.

LEIGH KENNEDY

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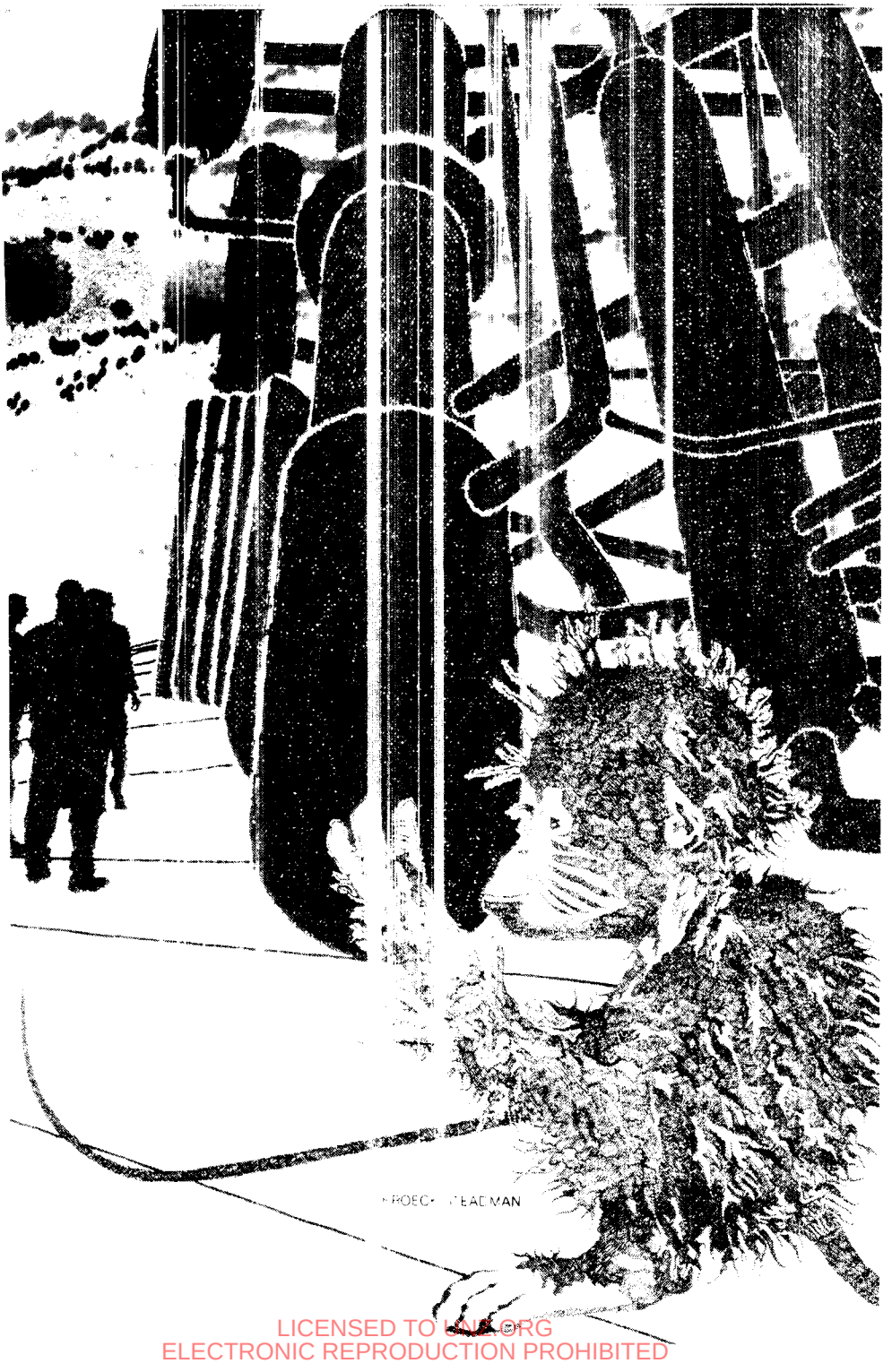

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Anointed by his reputation, Chasey felt the tossed-away crown of madness and xenophobia alight again—forced by a stranger's perceptions. It still caused old pains that this Doctor of Extraterrestrial Medicine probably knew only one thing about Frederick Chasey.

"Welcome to Beta Hydri, Doctor," Chasey said, standing on the jutting porch of headquarters.

"Thank you. Wasn't sure we'd made it. We barely missed close-range with a gaggle of Mix fighters," Doctor Hollen said. He pried his uniform collar from his neck with a bony finger, his eyes searching out every detail of the unfamiliar environment.

"Come on in," Chasey said. He motioned his new officer into the main hall of their headquarters. The building, built from an assortment of materials on hand—native woody material, the aluminum from their own mines, and stone—was already shabby and cluttered, though the base had been erected less than a decade ago. Imported from Delta Pavonis, the manufactures lacked refinement for all their utility. Shelves were crammed with readers, films, tools, a chess player, printers for official reports and paper for daily logs.

Chasey felt a gentle clawing at his shorts and absently reached down to pat Ticker, his "valet" Rainbow-face. The stringlike fuzzy stalks of the little native raised off her hide, a signal for scratching. "Not now, Ticker," he said, and the alien ceased her clinging, though touching one hand to Chasey's closest bare calf.

Chasey cleared the table of some of the communications equipment to make room for Hollen's elbow as he sat. Flushed and sweating, the doctor gratefully leaned. He wiped at his forehead. "Whoa, this place is miserably hot."

Chasey shrugged. "Don't know—I kind of like the warmer places. Climate's a little boring without the tilt, but I froze my ass off at Eta Cassiopeia A five years back and was glad to come down here."

Measuring the look in Hollen's eyes, Chasey thought, *he knows.* But Hollen managed a dry laugh. "Looks like we'll all be moving down here, pretty soon."

The victory of the Eridani Mix over the entire solar system chafed fresh. "When will this damned war finish?" he said, mostly to himself. "Ticker, bring him cafe."

He felt the warm moist presence of the Rainbow disappear from beside him. Without understanding why, he felt reluctant to watch Ticker with the doctor scrutinizing him. Chasey paced the buckled and squeaking floor, barely covered with a thin carpet. The louvered windshutters only kept out part of the slow, hot, breath-stealing breezes; dried leaves and dirt swirled into corners.

Ticker toddled back into the room with a covered mug of cafe and handed it to Hollen, who took the lid off and sipped in the steam clouds as if too thirsty to wait for it to cool.

"Clever aliens, these Rainbows,"

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Hollen said, watching Ticker settle on the floor, hind part lying, front limbs holding her shoulders and head up and alert. Streaked with orange, green, and violet, her baboonlike face gazed at Hollen steadily, curious.

"Do they have a registered lingua?" Hollen asked.

"No. I'm working on it. No one's done any scholarly work on them yet — just the official military sketches."

"You —" Hollen said incredulously, then winced.

Chasey smiled bitterly. He hesitated at making a quick reply, then decided to alter the tone. "They're great mine assistants. So . . . Where do you come from?"

"Mars."

Chasey nodded. "I'm from Earth."

They looked at each other openly for a few seconds, each measuring the other's hurt at the recent loss of the whole system. Chasey shunned the potential bond with Hollen that presented itself. He didn't even want to share loss with him. Hell, who was to say what belonged to whom anyway? The Eridani Mix were as Earth-sprung as the Galactic Allies, even with their improbable aliens called Plaps allied to them. There were no other "sentient" aliens in the twenty-five known light-year range around Sol that could be of any use to either side, except marginals used as slaves like the Rainbow-faces.

Chasey watched Ticker delicately pick crumbs off the floor. Hollen sighed. "I'm starting to feel better, but this heat's oppressive."

"Yes, rather greasy," Chasey said. "It's cooler further up the range, but on the upper plateau, air's thin. We're at the highest altitude without having to wear lifesupport."

"I've had enough of that."

Chasey wondered what a DEM would be doing in a lot of life support, but he suppressed his questions. It was growing night, judging by the rapid shift of violet and pink light. Chasey saw Hollen admire the colors, watching through the open door, and noted his surprise at the suddenness of nightfall. Chasey was hungry; hunger made him irritable. He waited impatiently for the walkways to be lit, the camp and mine guard towers to signal all well.

"...nothing like it since Horse's Rear-8832," Hollen muttered.

HR-8832. Chasey stood, clicked his forefinger and thumb nails together in a whisper to Ticker. The Rainbow rose from her leisurely position on the floor and followed Chasey as he rudely left his new officer alone in the darkness, most likely as hungry as anyone in the camp.

"Call it treason, but I'm happy about your assignment," his father had said. The old man sat by the kitchen window, Sol-light bleaching his face to a warm brown. Chasey remembered him peeling an orange, his great spatulate thumbs gently pulling the sweet sections out of the peel. Spray of orange-smell, drops of juice standing on the oiled grain of the table, the

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creak of an antique wooden chair.

"There must be a reason they call it Horse's Rear," Chasey said, pacing the tiled floor. "If they needed me as much as they said, why didn't they send me somewhere useful?"

The elder Chasey held out a section of orange, which the younger waved away. The old man's hands never wavered or trembled, epitomizing his easy good nature which Frederick took then to be a lack of conviction. "Frederick" the old voice hummed, "since you've chosen to pit yourself against the entire federation of Eridani upstarts, why don't you just go and do what you can to hold the Horse's Rear." The elder Chasey laughed then, but softly, respectfully.

"I'm a soldier, not a farm guard!"

His father shook his head. Chasey wondered even then what the old man could know about war that would give him such a desolate look.

Chasey thought he heard a shuffle in the hallway. Seeing no one from his chair, he indicated to Ticker to shut the door and began dictation.

"I don't pretend to be a specialist in the area, but aside from my position as Director General of Dole's Peak mining camp, Beta Hydri Habitable, I have a solid background in both physical and organic sciences. I feel qualified not only to coordinate the various observations of the scientists under my command, but to impart the original observations I have made on the natives to this planet, whom we call Rainbow-faces.

"The typical Rainbow-face is nearly a meter long, but rarely extends to full size, preferring to slouch, reminding one somewhat of a cross between a domestic dog and an amiable baboon. This quadraped's forepaws are prehensile, cephalic development and placement of sense organs all rather pleasing—if amusing—to humans..."

Again, shuffling, then a knock.

"Excuse me, sir."

Chasey unstiffened his neck and shoulder muscles consciously as he turned toward the door. "Yes, Hollen."

"I have a very sick old male down in the infirmary. I was told that you know him and might be able to help me calm him down."

Chasey almost asked for a name, but bit his question back, fearing every possible answer. *Oh, why aren't these beings immortal?*

Beta Hydri had already sailed far below the horizon. The floodlights around the camp illuminated the ground in patchy blue light. Chasey hated to go out at night, it was so easy to stumble in the pitted mountainside—the Rainbows loved a particular root and had no discretion about digging in the compound. Trying to restrain himself to a stroll, Chasey felt the oiliness of the heat and thick air rolling on his face and back, simmering on his shoulders. The heavy sweet scent characterized the area, rather like an underripe mango—peachy seasoned with turpentine. Around them, about four kilometers down

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Dole's Peak (itself an island) the endless slimy sea murmured tidelessly.

The planet was so barely habitable because of the vast ocean that when the first G.A. exploratory shuttle set down, the first impression left cartographers vexed for years. The mother ship asked for a description, the traditional moment to name a new planet. The shuttle captain took a look around, spending hours trying to find a place to land. She radioed back, "Wet." The astrocartographers thought that too terse, therefore it had remained Beta Hydri Habitable.

The infirmary windows glowed orange, patterning the pitted ground with light. A crowd of Rainbows had collected around the doorway, unwilling to go inside the square building, but too curious to stay away. Chasey noticed them all move aside quickly as Hollen passed through them; but they gathered around his own knees, searching for reassurance, caressing him with their damp fingers.

"It's all right," he said absently.

Some of them ticked and cooed in return.

The old male, a sandy, droop-eyed fellow, lay on the table, completely passive, watching the attendant. Chasey gripped the old Rainbow's arm. "Tiberius!" Chasey said.

"I don't see how you tell them apart," Hollen said.

Chasey felt a shudder of irritation. "How the gamma-delta did you get this assignment?"

Hollen flushed, then looked away.

The Rainbow reached up and patted Chasey's neck, then let his arm drop as if exhausted. "What's the problem, anyway?" Chasey asked.

"He's fairly old, I would say," Hollen said in a tight, controlled voice. "I think his excretory system has failed him. However he doesn't seem as agitated as he was a moment ago." Hollen wheeled a device close to the table. He looked into eyepieces projecting out of a metal neck hanging over the Rainbow. "That's a-boy, just lie still." The DEM walked around the table, peering into the machine as it rolled with him, scanning the old Rainbow.

Chasey stepped back out of the way. Tiberius watched him with a soulful glance from the table. Hollen wheeled close to Tiberius' head. Tiberius screamed—a Rainbow's scream, just at the top of human range, and a few decibels louder than pain. Hollen jumped back reflexively. Tiberius raised up from the table, howling and clicking simultaneously. He crawled up to a crouch on the table waving his dangerously strong arms at Hollen, orange spittle raining out from his lipless mouth.

"Tiberius," Chasey said. He walked forward slowly. The Rainbow's howl deepened, like a siren wailing down, then he cut it short. His eyes rolled. He tottered. Catching Tiberius as he fell, Chasey grunted with the weight. Hollen bore part of the weight as they lifted the old alien back onto the table.

Chasey stood aside, feeling his pulse battering within, his breath

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short, as Hollen examined Tiberius.

"He's dead."

Chasey stopped breathing altogether for a moment, then he gasped spasmodically. *Don't let it show.* Chasey nodded curtly and made his way to the door blindly. He stumbled three or four times on his way back through the pale darkness, picking a path in the cutouts between arc lights. He fell to his knees once, skinning the palm of his hand, bruising his shin on a rock, but he brushed himself off with some dignity. Luckily, the soldiers in the main hall were too absorbed in a card game to look at his face.

He left the light off in his quarters, curling up on his cot, trying to squeeze the grief out of his chest with his knees. Instead, it expanded with ominous painful power. He could barely catch his breath, his face ached. He rolled in misery, fighting down the scream. The scream welled within him, pushing on his throat and spine and diaphram until he almost exploded within his own chest.

Other agonies haunted him. Buttercup bright eyes gleaming out through shattering portholes. Memories of subsonic vibrations that he felt still when he awoke nights, hands and feet icy on this hot planet...

The door opened with a fumbling sound. Dim light from the hall splattered the floor, then disappeared.

He heard a soft "ooo."

"Ticker," he said, reaching for the familiar shape and smell. "Ticker."

She climbed up to him, touching his face with her mouth the way he'd taught her, drinking his tears.

Chasey watched his two children romping ahead in the grass. Lily tumbled on her chubby legs—running the way neophytes run—only to stay upright—then boom.... Her brother picked her up by the arm nonchalantly. They disappeared under a hedge of mock orange. The smell of late spring filled Chasey with more impatience instead of the longing that he suspected Celia plotted. The last week had been a hell of his favorites, the best, the sweetest. Celia had awakened him each morning pressing close.

"When you come back," Celia said brightly, "I'll be just about ready to present my paper."

Chasey walked beside her, hating her because she loved him, and hating her because in some ways he loved her, too. "Why didn't you join?" he said between his teeth.

She almost betrayed herself, waving an insect away nonchalantly. "I'm no soldier. Besides, it wouldn't be fair to your father to have to take the children. Why don't you stay, I'll go..." She laughed, too easily.

He stopped suddenly, looking into the sky, packed with heavy clouds from the west, otherwise clear. He judged the angle of Sol, the feel of the afternoon. "Well, Cel..."

"Not yet, Frederick," she said.

He took her hand, kissed her brow. "Tell them..." He looked for the children, but in spite of Lily's giggle, couldn't see them. Finding no words, no message, he said, "Love you all."

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Celia gazed away numbly.

He resisted looking over his shoulder as he walked toward Lagos Spaceport

Other soldiers who had been fond of Tiberius came. Besides being a hard-working and obedient mine assistant, he'd learned most of the names of equipment and could be trusted to fetch anything for anyone. He'd been a likely candidate for the presentient symbol language, but the opportunity to send him to Eta Cass A hadn't come until he was too old. He loved olive oil—to eat and to wear. This was the conversation as they carried the old Rainbow down the mountain. The Rainbows' fur slicked tightly against their hides, the soldiers in protective cooler suits, they wound down the glittering crystal trail, Beta Hydri beaming unmercifully close.

Chasey recognized and noted the fact that the Rainbows who carried Tiberius were all his blood relations. Aside from a disconnected humming song, they were quiet, their feet padding softly on the ground. They came to the edge of the grey-green sea, like a bright, reflecting stretch of mercury. The humans paused at the lip of the tideless beach while the aliens bore their dead to the water, letting him down. At first he floated, his multicolored muzzle peeking up out of the murk, then slowly he slipped down . . . down. . . . The Rainbows crouched, watching even beyond the time that there was anything to see.

Chasey, clenching his teeth, noticed the soldier next to him shudder. He looked at him; though he couldn't see the eyes behind the tinted visor, Chasey knew that he was young. There was almost a sob in the soldier's voice. "My God, Director, if they're just animals, then what are we?"

Chasey nodded dumbly. He felt a need to say something comforting, but found his tongue still. He shrugged. From behind, he felt that someone watched him. Hollen stood at stiff attention, his face to the sea.

In the old days, they used to call it marching, but marching implied an ordered rhythm, complete with stately and rousing music. Chasey was allergic to a basic one-celled organism in the soil of Horse's Rear Habitable—a planet called Garden. It was a fecund planet, slightly heavier, cooler, and wetter than Earth. The air around their camps remained thick with choking smoke—no single stick or twig, alive or dead, was dry enough for a crackling fire.

He usually huddled, itching and wheezing, by miserably smoldering fires, fanning the wood in hopes of a surprise flame or two. No chemical fires in the wilderness were allowed, partly because each soldier could only haul so much on his body. His clothes became moldy with a growth that had the odor of burning oil. He'd entertained great hope for that smell at first. When he found a big patch of it on a pair of worn G.A. socks, he tossed them onto the fire hoping for a blaze. He succeeded only in making

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the rations-master angry by putting out what little heat he had to cook their meal with.

Camp was bad enough, but the endless marching was worse. Every time he took a step, he wondered if he could take even one more. Five steps...

One: "Come on, *Chasey, what're you doing waltzing with that bush?"*

Two: his shoulders cramped and he tried to slip his pack off to hunch forward, but found his arms too exhausted to move.

Three: "Talo, dammit, help me!" he said. "Take my pack off! Get it off!" He felt the words shudder out of his mouth. The pain from the muscle cramps made him crazy. He'd rather die than take another step. His boot pulled reluctantly out of a mudhole, but not before half a liter of Garden's fine, fertile mud oozed through the cracks. His foot blossomed with rash, "TALO, DAMMIT!"

Four: whomp! Down on his face, writhing in the mud so poisonous to him. He rolled and somehow scraped the pack off his back and was in the process of ripping his boot off when Talo picked him up with the conviction of a seasoned veteran. "Chasey, if there's anything I can't take, it's a whining recruit. Do you think my pack bothers me? Of course it does! But we gotta go, fella, and that's all there is to it." And Chasey was on his feet again, holding the pack in arms that threatened to snap like too-taut elastic, shaking violently, splattered with itching muck.

Five: one more step....

He felt Hollen watching him. At meals. At meetings. As he strolled the compound. Down at the mine. Oh, sometimes, he would be pretending to watch the Rainbows doing their simple tasks at the less complicated machinery—doing some of the manual labor. The Rainbows enjoyed pleasing humans.

He noticed Hollen glance away at times when they listened in the communications room, waiting for the orbiter to send down the latest news. The Mix had taken a liking for Delta Pavonis, the industrial base, even though previously they had done most of their attacking in a more Sol-oriented direction. Now that they held most of the solar system, they looked elsewhere. But that news was slow in coming. By the time Beta Hydri knew the Galactic Allies had taken Titan, they'd lost it again. By the time the camp heard they'd lost it, the G.A. had battled their way almost to the asteroid belt again.

Hollen watched him through it all.

Even though there was no variation in climate on Beta Hydri Habitable due to no axial tilt, some days blew cooler than others. The first shift lunch ate outside in nearly pleasant weather. Chasey saw them from a distance as he returned alone from the mine.

Ticker met him at the gate, squeaking and jumping, but quieted down when he lifted her onto his shoulders. He felt good that day. The camp had been running smoothly, the G.A. had

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beaten the Mix near the Centauri system, and Hollen had been busy. Never able to figure why the man bothered him, he had a feeling that Hollen thought more about Chasey than Chasey did.

"Director, did you hear?" one soldier asked. "The Mix just got the cosmos whipped out of them—a huge fleet just one light from Delta Pav."

Chasey bounded up the steps into the crowded room. About twenty soldiers stood around communications. Hollen stood with the others, craning to listen to a voiceless interlude. "Well," Chasey said, "what d'you think? Will we be going home next week?"

"Are you going home when it's over, sir?" Hollen said, but as soon as the words were out he blanched, jerking his hand slightly forward as if to retrieve the words.

"Of course! Of course! We'll have Soi or I'm a Centurian worm."

"I didn't think . . . think you'd want to . . . because of what they say . . ."

Chasey looked away. He would pretend that he hadn't heard—that would be the polite way to handle insensitivity. "A Centurian worm," Chasey repeated and joined the others still trying to scan for the news orbiter.

What do they say?

One of the soldiers started a debate. "I don't care if they did wipe them out—Delta Pav is getting pretty close."

"Director," Hollen spoke close to his ear so that only Chasey could hear, "I'm sorry. I'm not very tactful."

"Doctor Hollen!" Chasey shouted. More, he held back.

The room exploded into a detailed silence. Chasey heard a whisper. He turned and saw a red face. Glaring, Chasey saw that Hollen's head trembled on his neck from nervousness. Oh the voiceless conversations they were having with their eyes! Everyone became transparently uncomfortable and fearful. Chasey felt a shudder of recognition—remembering an inquest in which the reek of xenocide drew elaborate figures into his wordless relationships with humans.

"Time for second lunch!" he bellowed at them all.

Chasey knew Talo well enough to recognize bad news on her face.

The paper fluttered into his hands. In the long, dim moment that followed, Chasey heard Webster. "That's a hell of a way to tell him."

Talo shrugged. "Tell him by degrees and it still comes down to the same truth."

Chasey read it again, and then again, and still once more. The lettering of the readout was so geometrical, so even, and with a certain art to the block print:

NOTIFICATION FOR ANY PERSONNEL NATIVE TO EARTH: PLEASE INFORM. ERIDANI MIX RAID ON AFRICA, ARABIA, ABOVE EQUATOR INVESTIGATED. DEVASTATION COMPLETE. NO CHANCE FOR EVACUATION. NO SURVIVORS.

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"I never realized Lagos was above the equator," Webster said weakly.

I'm taking this all right, Chasey thought. My father, my wife, my children. I haven't seen them in years anyway. I thought I would cry out, but I can't.... My heart seems to be pounding a little faster, that's all. My father, my wife, my children...

"Catch him," Talo said.

Chasey wished that he could take back the involuntary sound—like being shoved, an "uh-huh." When he awakened fully, he saw that the door was slightly ajar. Someone stood in the hallway.

"Who's that?" he said hoarsely. He cleared his throat and sat up, running his hand through his hair.

"Abu-ma, sir."

"Come in," he said, flicking on the night light.

The communications officer came in, treading quietly, as if the Director were still asleep. A long moment passed before he spoke. "They've taken Delta Pavonis, Director."

Chasey gripped the edge of his bed. "No..."

"The refugee headquarters ship has a message, sir."

Chasey shuddered. He felt Ticker stir at his feet on the floor, rising to listen. He sensed her alertness to the tension. Chasey nodded. "Be there in a moment."

He couldn't force himself to pull on his shorts quickly. Slowly, deliberately, he looked around the room, felt the brush of cloth on his legs, felt the greasy sweat film over his pores. He'd dozed off without the night oxygen and now felt dizzy and weak.

He felt his way to the main hall. All the night shift was awake, plus half of the rest of the camp.

Delta Pavonis. The closest G.A. system, and the biggest industrial habitable. Could it be that after all these decades, someone would actually win the war?

"This is Director General Chasey."

"Bad news, Director. Orders to evacuate."

Chasey rubbed his face sleepily. "Evacuate? Why?"

"Orders. The Mix has discovered our metal resources. All your mining personnel are in danger. Refugee ships from Delta Pav will be sending a shuttle down."

Chasey leaned on his palm, staring at the machine that he held this conversation with. He tried to make the right sounds, but it took several attempts before he managed the question. "Ah...we...what about the Rainbows?"

"Leave them. Things are too tight. We don't have the room or time for marginals and pets. Well, if you could get everyone ready in about five, six hours..."

Chasey wanted to find the right dial that would change the reality. The voice said something, but Chasey didn't hear.

"I'm not leaving," he said simply. "Not without them."

"Chasey..."

The refugee commander, probably

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preoccupied with various immediate disasters, used the tolerant voice that adults use with intelligent but mistaken children, that the sane use to the less sane. "Chasey, don't pull anything, huh?"

"Pull anything," Chasey repeated. He leaned forward. "We have to take the Rainbows or I..."

"No, Chasey, no." And again, the voice said, "no."

Chasey climbed up the steep hillside, his chest heaving, his lips stuck in a grimace of breathlessness.

"Director!"

Hollen again. Hollen, Hollen, Hollen. Why has he chosen to become my ghost? Ticker clicked and cooed to Chasey, touching his scraped arm.

"Director, stop. Please." Hollen was panting, beaming a dim light up the hill. "I have to talk to you."

Exhausted, Chasey sat on the ground. He tried to stop his gasping but could not. Hollen found him and dropped to the ground beside him. They sat side by side, each struggling with the thin air and demanding lungs.

"Director, what are you going to do?" Hollen finally asked.

"I can't make them understand." Miserably, Chasey clicked his tongue at Ticker and she cuddled near.

"You didn't try very hard," Hollen said bitterly. "Is it because of the Plaps?"

"Watch yourself, Doctor."

"You didn't try," he said.

"I can't reason with them!" Chasey shouted. He propped himself on one elbow. "They wouldn't believe me. Everyone thinks I'm..."

"Director, the Mix will fry them! Please!" Hollen's face was too close; Chasey scooted away from him.

Hollen let out a hiss of anger. "I'm going to ignore rank, Chasey. Listen, a long time ago I complained to someone that I was the loneliest person in the galaxy. He said to me, 'No, you're not. That's Frederick Chasey.' And when I found out who you were and what you did, I said to myself, I can understand that in a way. We can all get pushed too far. Obviously those in charge didn't think much of it—you still have rank and command. I applied to transfer here because I was fascinated with you and the Rainbows—even more so the combination. And I see that you love them more than you love us. Dammit, Chasey, I know it's true."

Chasey listened to Hollen with a sort of horrified fascination. "People talk about me...like that?"

Hollen nodded.

He closed his eyes and laughed. "I spit on your pity," he said suddenly, fiercely.

Hollen sat silently for a long while. He stood. "Is your feeling for them so unnatural and guilty that you can't even plead their cause? Are you that corrupt that you don't even really love *them*?"

"You're way out of line, Doctor," Chasey said with calm hatred.

"Do something!" Hollen's voice pitched with frustration. After an audible swallow, he said softly, "I

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see," and started down the hill.

Chasey listened to the DEM's footsteps crunch down the slope. He rocked slowly back and forth with Ticker in his arms.

If the humans were uncomfortable on Eta Cassiopeia A, the Plaps were probably more so. In the prisoner-of-war camp, they glided in rooms of hot, several Earth-pressures, poisonous atmosphere. It was still too cold and thin for them, but they remained alive, watching the humans through glass portholes. Eerie yellow eyes —four of them spaced evenly around their heads—afforded a complete view from their unstructured bodies. The Plaps had a solid skeleton of sorts underneath the flesh, and handlike appendages. That was almost requisite for any species to even approach sentience.

Chasey felt slyness gleaming out of those eyes as he ambled by the sanded boardwalk, shivering, teeth chattering even in the warm suit. His oxygen cannula bit into his nostrils. He was hungry. He needed to relieve himself, and the other night sentry was taking fifteen minutes extra on his break.

"Chasey, that you?"

Chasey turned. He saw an awkward figure, fully suited up in a life support suit (probably with a heater, Chasey thought resentfully) and broadcast unit.

His protection muffled his voice to a pitiful garble. "Who's that?" He searched for his weapon, which was snapped away in his outer covering... somewhere...somewhere...

"Me. Talo." Her voice was tinny.

"Talo! Son of a bitch, Talo! How'd you have the luck to get on this paradise?" Chasey laughed. If he could be glad to see anyone, it would be his old marching comrade from Garden.

Talo laughed with him. "Luck," she said drily. "How'ya been?"

"Not bad. Ever since you pulled me outa the mud, I've been learning how this system works." He indicated the patch on his chest.

Talo clicked on her fingertip beams and inspected it, then whistled. "So, big shot, what are you doing on night watch?"

"Trying to be fair. Actually, this place is loaded with officers. Even though it's cold, this is a soft place to be. We're just baby-sitting the melted men here." He tapped a porthole. A triad of buttercup-bright eyes blinked out at them.

"Plaps?" Talo said. "I've never seen them." She stepped closer to the window and looked in. "Yeecch."

"Beats playing real soldier. I like the Ex-tee corps. We made a lot of faces through the window, but don't kill each other."

"Yeah?" Talo said. "I'm surprised you're so patient with them. I don't know if I could be."

Chasey frowned, but to no avail. Both of them were rigged beyond facial communication. "Why's that?"

Talo hesitated. "Didn't you know, Chasey? The Plaps did the raid on Africa."

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Chasey considered for a moment. He turned to the window and saw the eyes peering out at him—hundreds of wise, glowing eyes...

Talo sipped her tea noisily. "I guess I didn't know at the time, either, Chasey. I can't remember now. But I've done so much reading lately..."

"Oh, you've been on soft assignments, too, huh?"

"Careful, Chasey. You know I spend my spare time reading instead of sulking around like you."

"Hey now." Chasey watched her face keenly. "You know—I'd like to be stuck here for awhile if you're going to be here."

She smiled.

"I'd like to be stuck with you somewhere after this war is over," he said, drawing from her expression.

She laughed. "You remember the painter—Samo? You remember how his painting 'Desperate City' was banned twenty years ago? It was treason, showing Earth that way. All those orange flames of despair, and the grey-green of decay. Remember, Chasey?"

"Sure."

"I saw prints of it on sale on Delta Pavonis. I swear. This war's never going to end. It's so much a part of our culture that they aren't sensitive to what they called treason a few years back."

Chasey frowned, turning his mug round and round in his hands. Did it matter? He glanced at Talo as she rose for a refill. It could. It could.

They were together, suited up for hostile, armed, but the others of the inspection team lagged and they were alone with all those creatures. Chasey

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had been in with the Plaps before, but not since he'd known.... Scanning the compound warily, he wondered why he'd been so eager to come in this time. Pressure weighted their movements. "Where are the others?" he asked impatiently.

"What's the matter, Chasey?" Talo said. "Nervous?"

"They give me a sick feeling."

They walked slowly through the sections, surveying the floors, the niches, the hammock-type beds, for any sign of a makeshift Plap weapon. There could be no hope for a group on a hostile planet, but there was always a chance of suicide rebellion, just to take out a few G.A.'s.

"Aw, they're cute!" Talo said playfully. She reached out to one.

"Don't..." Chasey couldn't hear the sound that the Plap made, but the subsonic rumble roared through his body, vibrating him like a cello string. The Plap that Talo touched rippled its flesh hideously, and—SWAP!

Chasey stood in shock, seeing Talo's suit shatter at the shoulders. She didn't even have time for a scream. Blood splattered on his visor and his gloves as he tried to reach for her falling body.

The Plap turned to Chasey, but he managed to overcome the high-pressure atmosphere for a quick shot. He made a clean swipe diagonally through the alien's body. Others lunged at him. He screamed.

Alone with hundreds of oozing, murderous aliens.

He held the trigger and whirled his weapon around and around, killing several. He ran for the door. They tried to touch him, but he swung and darted. They backed off from his weapon. They seemed to be telling each other to let him go. One G.A. wasn't worth the trouble he would cause. Perhaps they hoped more would come in.

Chasey spent a million years fumbling in the airlocks. He stood outside the door, staring at the others, who had just arrived. "Good God, is that blood?"

Unable to communicate his disgust, rage, grief and hatred, he pushed them, heading for the maintenance shed. When he returned with his newly acquired weapon, they were carrying out what was left of Talo. If they saw him they paid little attention.

He started with the bigger portholes at the north end of the building. Swinging the heavy crowbar, he flinched as the shattered glass tinked against his visor. The poisonous atmosphere of the Plaps gushed out, nearly knocking him down. At the next porthole, he was careful to stand aside as he swung. Lipless, soundless screams of fury hummed through the foul gases hissing outward. Chasey saw them watching him as their flesh seared with cold, as they rippled with the effort even to breathe.

"Justice!" he screamed, swinging his angry tool. "Justice!" And he continued to smash, and smash...

"I want to talk to the ship," Chasey said, sitting down at the comm-desk.

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"Yes, sir." Abu-ma set it up and made the connection.

"Chasey here," he said. "I have a request."

"What?" The ship's commander sounded tired and harassed.

"Pick up all my people and then, if you can, send a later ship for me. The Rainbows and I can continue with the mining."

"No way in hell can we get a second shuttle for that."

Chasey closed his eyes and whispered into the mike. "Please."

After a hesitation, the voice came back cruelly clear. "You mean the Chasey who murdered hundreds of Plaps is willing to get scorched for some twittering baboons?"

"Yes," he said.

"Good Lord."

Chasey was silent. He'd spent all he had on a quiet "please." He had to think. . . . Straightforward requests from a madman obviously meant nothing to the rest of the galaxy.

"Get your people ready, Director. The shuttle will be launched in about an hour."

"There's nothing to be done about the Rainbows, then?" he said calmly.

"Nothing now. Perhaps the next time a freighter passes, if the planet hasn't been taken. . . ."

"I see. Thank you." Chasey stood.

Abu-ma signed off. Chasey gave orders to have everything ready to go within an hour and a half. There was hesitation in Itzak's eyes and posture.

"Get to it!"

They scrambled. He'd always exploited their fear of him—harsh tones did wonders to make them think about his past and possible future behaviors. Chasey went to his quarters and packed up his notes, books, two changes of clothes. Then he strolled into the mess and casually asked the soldiers why they were packing food.

"There's plenty of food on the ship, I'm sure," he said. "Leave everything."

"Yes, sir."

Glancing around, he saw that one man could live for months on the supplies. Besides that, he found some of the roots that the Rainbows ate to be tolerable, though low in human food value.

Hell. If I die, I die, he thought, feeling rather placid. But to give in without fighting this time, to watch the end of those he loved without doing something—that he could not do again.

He walked to the munitions shack, Ticker joining him outside, and gave them the same order as the mess.

"Traveling light," he said.

"Will they let us trade these for some of the Rainbows?" a soldier asked, after setting down a crate of surface arms.

"I don't think so," he said.

"Director. . . ."

Chasey left the shack.

He sat on the steps of headquarters, sipping a cafe. Ticker leaned against his back, a favorite position of hers. She picked at the hair on the back of his neck, making him shudder as he

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watched the rich sky of Beta Hydri Habitable. . . . Waiting. . . .

Working harder than was comfortable, the soldiers sweated and wiped their brows as they busily crossed between buildings. Vehicles were loaded, any trace of military or mining knowledge either burned in a bonfire east of the camp or carefully boxed and loaded.

They asked him about this or that, what to do with certain items, how to manage one or another problem. Quietly, he answered, sometimes nearly smiling.

Hollen skidded to the steps of headquarters, stopping short of bounding up the stairs. He studied Chasey, who returned an unconcerned gaze. "Well?"

"Well?" Chasey said.

"What are we going to do?"

"Leave."

"Are you going?"

Suddenly angered at Hollen's disturbing ability to wriggle into his thoughts, Chasey paused long enough to give Hollen his answer.

"I'll stay, too," the DEM said.

"Get out of here," Chasey said. Ticker crouched beside him, wary, her colorful muzzle muted by the blue arclights. "Get out!"

Hollen sat down on the ground with his back to Chasey, staring off into the same nothingness that Chasey stared into. One of his infirmary assistants approached Hollen. "Dr. Hollen, are we taking the big stuff, sir?"

Hollen shrugged. "Leave it. I'm going to stay."

"Stay. . . ."

"Stay," Hollen repeated.

Chasey thought about thrusting his boot onto the back of Hollen's neck. "I'm Director, Hollen, and you will not change one order I've given or I'll expose you on the Peak personally."

The infirmary assistant sensed the conflict between officers and respectfully stumbled away.

Chasey tried to think, but all that came to mind was his father's big brown thumbs gently peeling an orange as he talked about the uselessness of fighting wars. How long ago, how many light years away. . . . And Lily giggling under a mock orange hedge, and Talo laughing at the farces of loyalty and treason. He even considered the idea, as he had before, that perhaps somewhere in a hot, dense atmosphere, buttercup-bright eyes looked out through the heavy air and felt loss.

He sensed a change in the movements in camp. Less people carried their loads to the vehicles. Beside the massive shadows of transports, bundles lay upon the ground in weird blue light as soldiers talked and gestured together. Through open doorways those who had been packing now stood. Conversations. Everybody was talking. Pale ovals of face in the shadows flashed toward him, and then away again.

Chasey rose and walked into headquarters. "Set up a general page for me," he said sharply. Ticker touched his calf with a sticky hand.

Abu-ma obeyed directly. Chasey

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stood as he talked, looking out the window. "What's going on out there?" he said sternly. "Snap to!"

He stood in the doorway. Ticker begged him to let her up on his shoulder with a soft mumble, patting her own shoulder. He stooped and let her clamber on.

The groups broke up momentarily, but Chasey saw a pattern of runners between buildings and vehicles, hurrying down the walkways. Soldiers condensed into a mass in the center of the compound. Chasey heard chatter, but no words. Dr. Hollen rose, turned and looked at Chasey questioningly.

Two men broke away from the group. Chasey heard their shoes scraping on the gravel, but they kept averted faces until they stood at the steps of headquarters.

"What do you think you are doing?" he demanded.

"Sir . . ." Uncertainly, the soldier Chasey recognized as Watson, mining engineer, stepped closer. "Sir, we heard you are staying."

"And you believe rumors."

"Well, we were thinking that... well, a lot of us would rather stay, too, if we could. We're not very political. Maybe we'd be prisoners, but somebody's got to protect the Rainbows. It would be on our consciences to leave them."

"Conscience!" Chasey said, laughing. "You don't win wars with conscience, do you?"

"No, sir. That's the trouble with it," Hollen said.

Chasey might have laughed. He might have gotten angry. He might have been stung. But he was confused. Here was a group of people—no, not just people—soldiers and military scientists, fully aware of the possibility that the Mix felt confident enough of their own resources to simply melt Beta Hydri Habitable. Or perhaps they would be taken prisoner. But these soldiers chose to stay because of some "twittering baboons."

They loved them...

They loved them the way Chasey loved them, only guiltlessly. Chasey felt it now. He regarded the soldiers, waiting for him to say or do something. They believed that he could.

"Abu-ma," Chasey said, "let me talk to the ship again."

Chasey waited upon the steps again. The streak of fire in the north had scratched the leaden dawn of Dole's Peak; he'd bid safe journey to half his camp and three clans of Rainbows. Even in the uncertainties of shuttling through the galaxy, he felt that everything was all right.

It could be days, a week, or more until the next shuttle arrived. Which would come first? Perhaps it would be the larger glare of a warship bearing down upon them.

Chasey knew that at last he'd done something right. Tall humans milled restlessly around the camp, Rainbows crouched among them, breathing each other's air, touching, whispering and ticking.

The tossed-away crown would not easily alight again. ■

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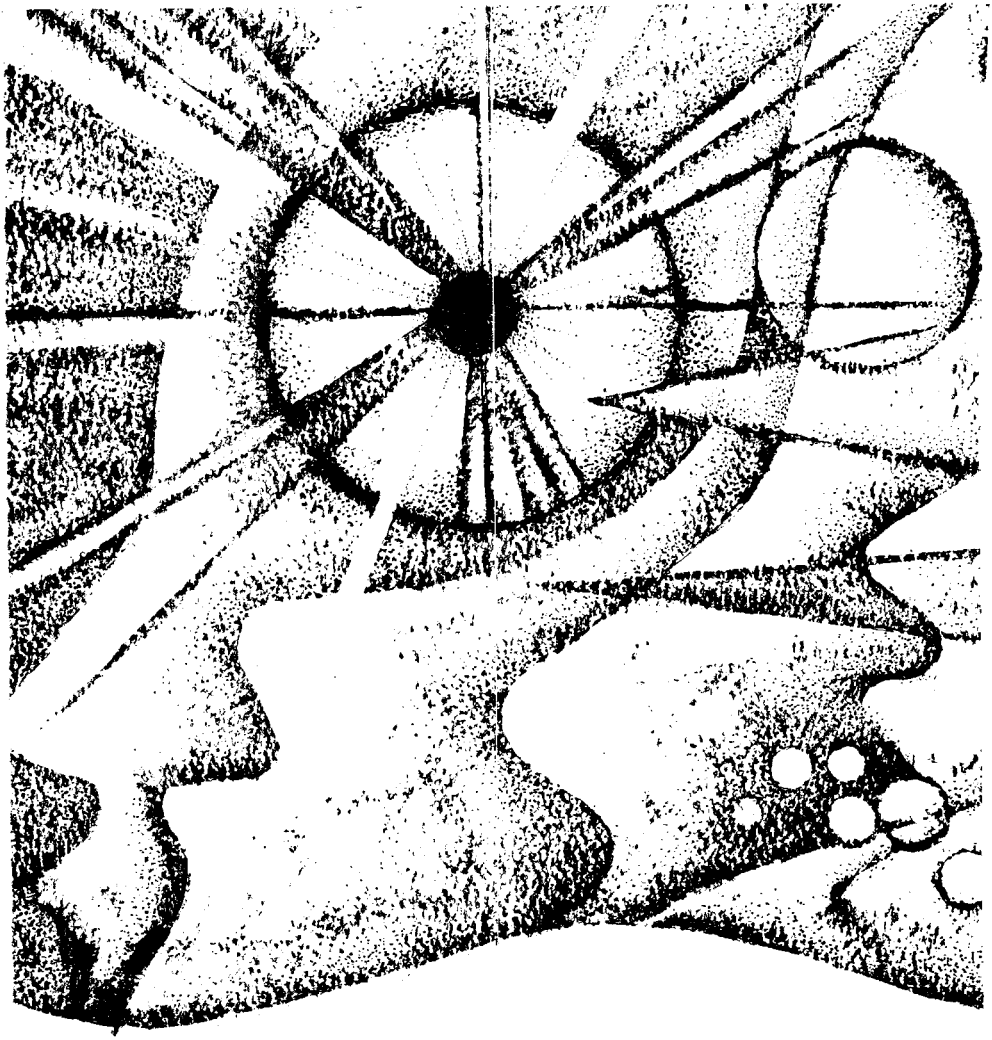

ISAAC ASIMOV

THE LAST answer

**The oldest beliefs may contain truth—
but not necessarily
for the reasons usually assumed.**

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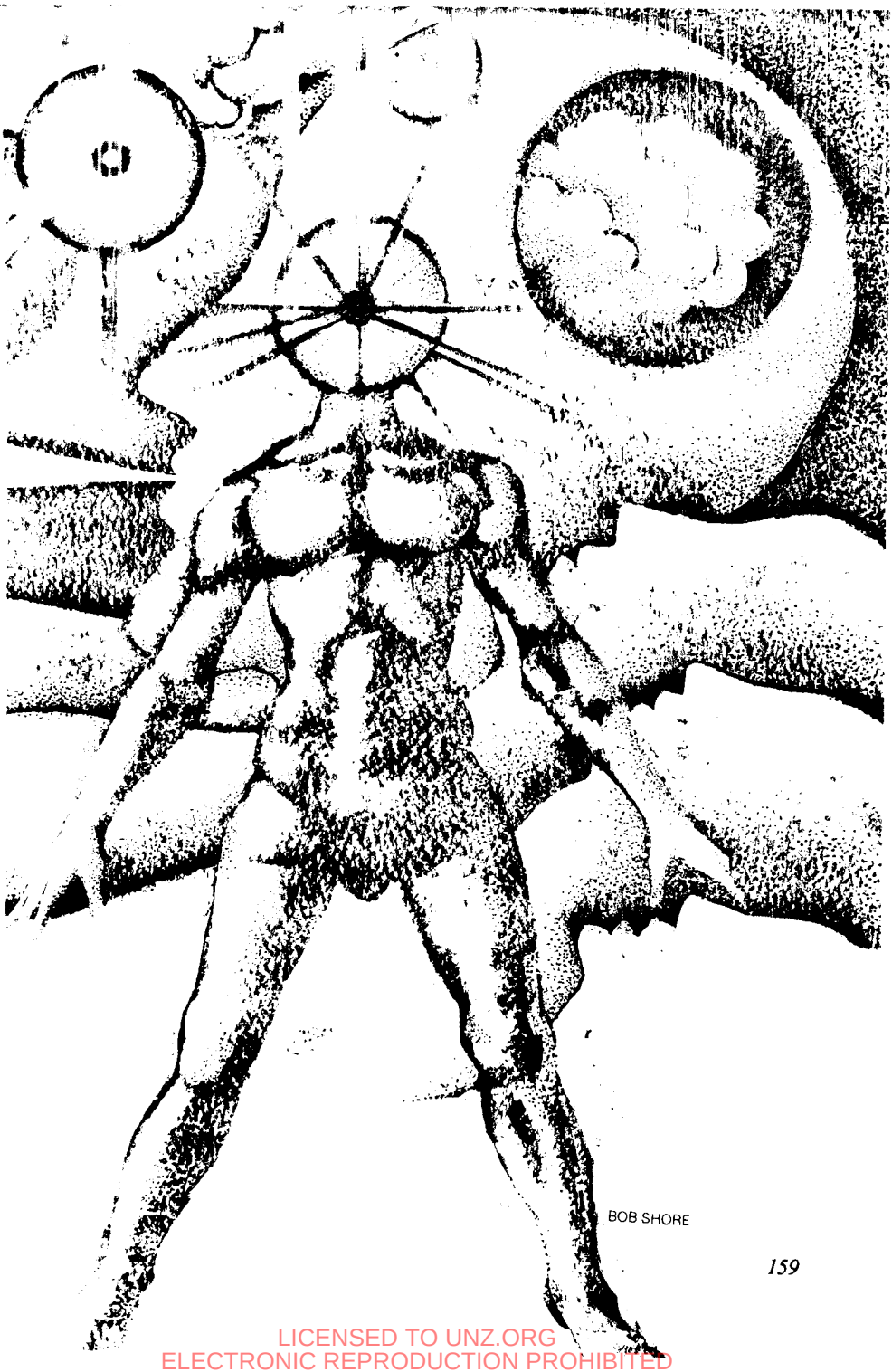

BOB SHORE

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Murray Templeton was 45 years old, in his prime and with all parts of his body in perfect working order except for certain key portions of his coronary arteries, but that was enough.

The pain had come suddenly, had mounted to an unbearable peak, and had then ebbed steadily. He could feel his breath slowing and a kind of gathering peace washing over him.

There is no pleasure like the absence of pain—immediately after pain. Murray felt an almost giddy lightness as though he were lifting in the air and hovering.

He opened his eyes and noted with distant amusement that the others in the room were still agitated. He had been in the laboratory when the pain had struck, quite without warning, and when he had staggered, he had heard surprised outcries from the others before everything vanished into overwhelming agony.

Now, with the pain gone, the others were still hovering, still anxious, still gathered about his fallen body—

—Which, he suddenly realized, he was looking down on.

He was down there, sprawled, face contorted. He was up here, at peace and watching.

He thought: "Miracle of miracles! The life-after-life nuts were right."

And although that was a humiliating way for an atheistic physicist to die, he felt only the mildest surprise, and no alteration of the peace in which he was immersed.

He thought: "There should be an angel, or something, coming for me."

The Earthly scene was fading. Darkness was invading his consciousness and off in a distance, as a last glimmer of sight, there was a figure of light, vaguely human in form, and radiating warmth.

Murray thought: "What a joke on me. I'm going to heaven."

Even as he thought that, the light faded, but the warmth remained. There was no lessening of the peace even though in all the Universe only he remained—and the Voice.

The Voice said, "I have done this so often, and yet I still have the capacity to be pleased at success."

It was in Murray's mind to say something, but he was not conscious of possessing a mouth, tongue or vocal cords. Nevertheless, he tried to make a sound. He tried, mouthlessly, to hum words or breathe them or just push them out by a contraction of—something.

And they came out. He heard his own voice, quite recognizable, and his own words, infinitely clear.

Murray said, "Is this Heaven?"

The Voice said, "This is no place as you understand place."

Murray was embarrassed, but the next question had to be asked. "Pardon me if I sound like a jackass. Are you God?"

Without changing intonation or in any way marring the perfection of the sound, the Voice sounded amused. "It is strange that I am always asked that in, of course, an infinite number of ways. There is no answer I can give that you would comprehend. I *am*—which

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is all that I can say significantly and you may cover that with any word or concept you please."

Murray said, "And what am I? A soul? Or am I only personified existence, too?" He tried not to sound sarcastic, but it seemed to him that he had failed. He thought then, fleetingly, of adding a "Your Grace" or "Holy One" or *something* to counteract the sarcasm, and could not bring himself to do so even though for the first time in his existence he speculated on the possibility of being punished for his insolence—or sin?—with Hell, and what ever that might be like.

The Voice did not sound offended. "You are easy to explain—even to you. You may call yourself a soul if that pleases you, but what you are is a nexus of electromagnetic forces, so arranged that all the interconnections and interrelationships are exactly imitative of those of your brain in your Universe-existence—down to the smallest detail. Therefore you have your capacity for thought, your memories, your personality. It still seems to you that you are you."

Murray found himself incredulous. "You mean the essence of my brain was permanent."

"Not at all. There is nothing about you that is permanent except what I choose to make so. I formed the nexus. I constructed it while you had physical existence and adjusted it to the moment when the existence failed."

The Voice seemed distinctly pleased with itself, and went on after a moment's pause. "An intricate but entirely precise construction. I could, of course, do it for every human being on your world but I am pleased that I do not. There is pleasure in the selection."

"You choose very few then."

"Very few."

"And what happens to the rest?"

"Oblivion!—Oh, of course, you imagine a Hell."

Murray would have flushed if he had the capacity to do so. He said, "I do not. It is spoken of. Still, I would scarcely have thought I was virtuous enough to have attracted your attention as one of the Elect."

"Virtuous?—Ah, I see what you mean. It is troublesome to have to force my thinking small enough to permeate yours. No, I have chosen you for your capacity for thought, as I choose others, in quadrillions, from all the intelligent species of the Universe."

Murray found himself suddenly curious, the habit of a lifetime. He said, "Do you choose them all yourself or are there others like you?"

For a fleeting moment, Murray thought there was an impatient reaction to that, but when the Voice came, it was unmoved. "Whether or not there are others is irrelevant to you. This Universe is mine, and mine alone. It is my intention, my construction, intended for my purpose alone."

"And yet with quadrillions of nexi you have formed, you spend time with me? Am I that important?"

The Voice said, "You are not im-

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portant at all. I am also with others in a way which, to your perception, would seem simultaneous."

"And yet you are one?"

Again amusement. The Voice said, "You seek to trap me into an inconsistency. If you were an amoeba who could consider individuality only in connection with single cells and if you were to ask a sperm whale, made up of 30 quadrillion cells, whether it was one of many, how could the sperm whale answer in a way that would be comprehensible to the amoeba?"

Murray said dryly, "I'll think about it. It may become comprehensible."

"Exactly. That is your function. You will think."

"To what end. You already know everything, I suppose."

The Voice said, "Even if I knew everything, I could not know that I know everything."

Murray said, "That sounds like a bit of Eastern philosophy—something that sounds profound precisely because it has no meaning."

The Voice said, "You have promise. You answer my paradox with a paradox—except that mine is not a paradox. Consider. I have existed eternally, but what does that mean? It means I cannot remember having come into existence. If I could, I would not have existed eternally. If I cannot remember having come into existence, then there is at least one thing—the nature of my coming into existence—that I do not know.

"Then, too, although what I know is infinite, it is also true that what there is to know is infinite, and how can I be sure that both infinities are equal. The infinity of potential knowledge may be infinitely greater than the infinity of my actual knowledge. Here is a simple example: If I knew every one of the even integers, I would know an infinite number of items, and yet I would still not know a single odd integer."

Murray said, "But the odd integers can be derived. If you divide every even integer in the entire infinite series by two, you will get another infinite series which will contain within it the infinite series of odd integers."

The Voice said, "You have the idea. I am pleased. It will be your task to find other such ways, far more difficult ones, from the known to the not-yet-known. You have your memories. You will remember all the data you have ever collected or learned, or that you have or will deduce from that data. If necessary, you will be allowed to learn what additional data you will consider relevant to the problems you set yourself."

"Could you not do all that for yourself?"

The Voice said, "I can, but it is more interesting this way. I constructed the Universe in order to have more facts to deal with. I inserted the uncertainty principle, entropy, and other randomization factors to make the whole not instantly obvious. It has worked well for it has amused me for its entire existence.

"I then allowed complexities that produced first life and then in-

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telligence, and used it as a source for a research team, not because I need the aid, but because it would introduce a new random factor. I found I could not predict the next interesting piece of knowledge gained, where it would come from, by what means derived."

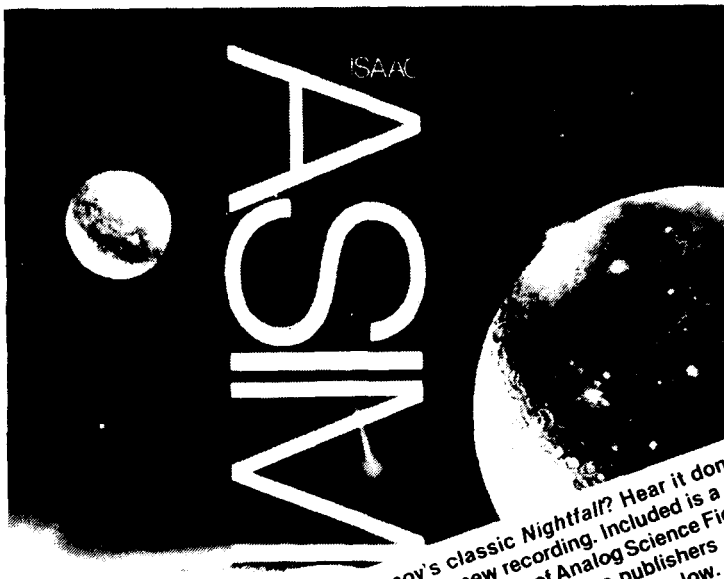
"Does that ever happen?"

"Certainly. A century doesn't pass in which some interesting item doesn't appear somewhere," the Voice said.

"Something that you could have thought of yourself, but had not done so yet?"

"Yes."

Murray said, "Do you actually



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think there's a chance of my obliging you in this manner?"

"In the next century? Virtually none. In the long run, though, your success is certain, since you will be engaged eternally."

Murray said, "I will be thinking through eternity? Forever?"

"Yes."

"To what end?"

"I have told you. To find new knowledge."

"But beyond that. For what purpose am I to find new knowledge?"

"It was what you did in your Universe-bound life. What was its purpose then?"

Murray said, "To gain new knowledge that only I could gain. To receive the praise of my fellows. To feel the satisfaction of accomplishment knowing that I had only a short time alloted me for the purpose. —Now I would gain only what you could gain yourself if you wished to take a small bit of trouble. You cannot praise me; you can only be amused. And there is no credit or satisfaction in accomplishment when I have all eternity to do it in."

The Voice said, "And you do not find thought and discovery worthwhile in itself? You do not find it requiring no further purpose?"

"For a finite time, yes. Not for all eternity."

"I see your point. Nevertheless, you have no choice."

"You say I am to think. You cannot make me do so."

The Voice said, "I do not wish to constrain you directly. I will not need to. Since you can do nothing but think, you will think. You do not know how not to think."

"Then I will give myself a goal. I will invent a purpose."

The Voice said tolerantly, "That you can certainly do."

"I have already found a purpose."

"May I know what it is?"

"You know already. I know we are not speaking in the ordinary fashion. You adjust my nexus in such a way that I believe I hear you and I believe I speak, but you transfer thoughts to me and from me directly. And when my nexus changes with my thoughts you are at once aware of them and do not need my voluntary transmission."

The Voice said, "You are surprisingly correct. I am pleased. —But it also pleases me to have you tell me your thoughts voluntarily."

"Then I will tell you. The purpose of my thinking will be to discover a way to disrupt this nexus of me that you have created. I do not want to think for no purpose but to amuse you. I do not want to think forever to amuse you. I do not want to exist forever to amuse you. All my thinking will be directed toward ending the nexus. *That* would amuse *me*."

The Voice said, "I have no objection to that. Even concentrated thought on ending your own existence may, despite you, come up with something new and interesting. And, of course, if you succeed in this suicide attempt you will have accomplished nothing, for I would instantly

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reconstruct you and in such a way as to make your method of suicide impossible. And if you found another and still more subtle fashion of disrupting yourself, I would reconstruct you with that possibility eliminated and so on. It could be an interesting game, but you will nevertheless exist eternally. It is my will."

Murray felt a quaver but the words came out with a perfect calm. "Am I in Hell then, after all. You have implied there is none, but if this were Hell you would lie as part of the game of Hell."

The Voice said, "In that case, of what use to assure you that you are not in Hell? Nevertheless, I assure you. There is here neither Heaven nor Hell. There is only myself."

Murray said, "Consider, then, that my thoughts may be useless to you. If I come up with nothing useful, will it not be worth your while to—disassemble me and take no further trouble with me."

"As a reward? You want Nirvana as the prize of failure and you intend to assure me failure? There is no bargain there. You will not fail. With all Eternity before you, you cannot avoid having at least one interesting thought, however you try against it."

"Then I will create another purpose for myself. I will not try to destroy myself. I will set as my goal the humiliation of you. I will think of something you have not only never thought of but never could think of. I will think of the last answer, beyond which there is no knowledge further."

The Voice said, "You do not understand the nature of the infinite. There may be things I have not yet troubled to know. There cannot be anything I cannot know."

Murray said thoughtfully, "You cannot know your beginning. You have said so. Therefore you cannot know your end. Very well, then. That will be my purpose and that will be the last answer. I will not destroy myself. I will destroy *you*—if you do not destroy me first."

The Voice said, "Ah! You come to that in rather less than average time. I would have thought it would have taken you longer. There is not one of those I have with me in this existence of perfect and eternal thought that does not have the ambition of destroying me. It cannot be done."

Murray said, "I have all eternity to think of a way of destroying you."

The Voice said, equably, "Then try to think of it." And it was gone.

But Murray had his purpose now and was content.

But what could *any* Entity, conscious of eternal existence, want—but an end?

For what else had the Voice been searching for countless billions of years? And for what other reason had intelligence been created and certain specimens salvaged and put to work, but to aid in that great search? And Murray intended that it would be he, and he alone, who would succeed.

Carefully, and with the thrill of purpose, Murray began to think.

He had plenty of time. ■

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BIOLOG

by Jay Kay Klein

Nothing of any importance has ever happened to Isaac Asimov, as he points out in his autobiography In Memory Yet Green. Still, he managed to come up with 732 pages on the first 34 years of his life. A sequel, In Joy Still Felt, will cover the next 25 years.

Brought to the United States at age two by Russian-born parents, Isaac spent his free hours working in the family candy store in Brooklyn. He learned to live within his mind, the store's supply of science fiction magazines introducing him to a wide universe. To this day, he works in a totally enclosed room, without the admittance of daylight. His early regimen of required diligence still brings him to work ten hours a day, seven days a week.

The result is monumental. Books in Print 1978-79 has 208 listings for him, not counting collaborations or books he edited. Another 64 listings are noted in the Supplement. Included are books ranging from the scientific and science fictional to three volumes of Lecherous Limericks.

In person he is as ebullient, articulate, and humorous as his nonfiction writings. He is also equally immodest about his intellectual gifts, but escapes general censure through geniality and a wholly down-to-earth attitude.

Isaac attended Columbia University's Seth Low Junior College in Brooklyn, transferring after a year to the Manhattan campus and receiving a B.S. in chemisty at nineteen. After time out for World War II and working at the Philadelphia Navy Yard with Robert Heinlein and Sprague de Camp, he received a Ph.D. in biochemistry from Columbia. He soon secured an appointment at Boston University School of Medicine, but left after several years upon discovering he was making more money writing.

While still an undergraduate, Isaac wrote his first science fiction story, personally taking it to his favorite magazine, Astounding. The encouragement from that meeting and the many others that followed culminated first in a minor sale four months later to another magazine and then publication in what has been called the issue marking the beginning of science fiction's Golden Age, the July, 1939 Astounding.

Isaac has many times said that he owes everything to John Campbell and science fiction. The 1966 World Science Fiction Convention voted his Foundation stories a special Hugo for Best All-Time Series. Subsequent world conventions and the Science Fiction Writers of America awarded Hugos and Nebulas for The Gods Themselves and "The Bicentennial Man."

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THE REFERENCE LIBRARY

BY TOM EASTON

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Enterprise, Jerry Grey, Morrow, 288 pp., $10.95.
Broca's Brain, Carl Sagan, Random House, 347 pp., $12.95.

You have all heard of simultaneous discoveries, inventions, and publications in science. They are a part of the history of academe, together with the ensuing fights, rivalries, and competitions for primacy, and there are more or less accepted procedures for deciding how the credit gets shared. They are not common in literature, however—I don't know that I have ever heard of a case before, at least not one as thorough-going and unambiguous as the one that has emerged this year.

The case begins with Arthur C. Clarke's *Fountains of Paradise*, a typically excellent product of one most of us would call a master of science fiction. It blends a touch of mysticism with hard engineering, the construction of a "bridge" to geosynchronous orbit. The principle is that an elevator can be built from a spot on Earth's equator into space. The bridge's center of mass must be at geosynchronous orbit, which means the twenty-odd thousand miles reaching down to Earth must be balanced by an equal mass extending further into space. The construction is possible only because of the recent perfection of high-tensile-strength cable made of monocrystalline fibers.

The idea is not Clarke's personal invention the way geosynchronous satellites were. It has been floating around in the technical literature for many years. It is therefore not entirely surprising that someone else should use the same idea as the basis for a story. What is surprising is that someone should do a job that is in ways better than Clarke's, and that he should correct Clarke's physics in a way that makes the story's accomplishment even more spectacular.

The someone is Charles Sheffield, president of the American Astronautical Society. The story is **The Web Between the Worlds.** The technical correction is that it is not possible to build the bridge *in situ*, ex-

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tending the structure simultaneously Earthward and spaceward from the center of mass. If you try, the structure becomes unstable and its orientation goes to pot. Instead, the whole 100,000 km cable should be assembled at a Lagrangian point (using asteroidal raw materials) and then flown into position. And that last is the spectacular. Imagine, if you can, 100,000 kilometers of cable, a meter thick at the narrow spots, uncoiling from its assembly spot and arrowing toward Earth like a cosmic pole vaulter. Its tip plunges through the atmosphere and into a socket awaiting it near Quito. Simultaneous with the touchdown, a billion-ton asteroid is attached to the far end as a ballast, and centrifugal force draws the cable into a taut, quivering highway to the stars. If anything goes wrong, the cable will whip around the Earth, shattering whatever bits of civilization are in the way and probably causing tidal waves and earthquakes.

But this spectacular is by no means the whole story. There are vast chunks of innovative technology, such as the Spiders, huge machines which resemble their namesakes both in form and in their role of spinning out finished cable. There is the civil engineer, Rob Merlyn, who goes from building large groundside bridges to building what Sheffield constantly refers to as the "beanstalk" (Merlyn is another remarkable parallel with Clarke). There are complications, but none of the political maneuvering Clarke covered so well (that all happens offstage) and none of the technical near-disasters that gave Clarke's tale much of its tension. Instead, Sheffield relies on a parallel plot for his tension—Merlyn's parents were killed before his birth (that's right—Mama, too), and the story's plot centers on the progressive unraveling of who did it, and why. It disappoints me that the villain is a ruthless genetic engineer involved in unethical experiments, but I must admit that there often is some antipathy between the physical and natural scientists. They compete with each other for funds and the public's affections, and the natural scientists —thanks to the image of medicine— seem to win. It is natural enough for a physical scientist to cast a biologist as a villain, I suppose, but it doesn't please me. Perhaps that is simply because I am a biologist myself. At any rate, *Web* is well worth reading. This is particularly true if you have already read the Clarke book, for the two together make a fine demonstration that the gimmick is not everything, even in science fiction.

This month's book stack contains three more high-technology novels. I will deal with them before going on to softer targets. The first is Walling's **The World I Left Behind Me.** It is the story of the development of a star drive, based on the idea that quarks, which in one model are the ends of one-dimensional filaments, can be aligned throughout a body of matter; when this is done for a spaceship, it enters a realm—subspace?—that permits faster-than-light travel. The technology is the product of an SF cliche, the one-genius research team whose associates handle mostly such donkey work as navigation, fund-raising, and lifting heavy objects. The story is raised slightly above the cliché level by a plot involving two groups of aliens, one handing out

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hints and encouragement, one trying to stop the project. The latter seems to be winning, thanks to such tactics as crashing an asteroid into the research base and putting out anonymous press releases that turn the people on Earth against the tremendous waste of money on star travel ("But we need the money *here!*"). However, the researchers finally win by hijacking an interplanetary liner and installing their drive. The story is standard, even to the love interest—while not the chief bigbrain's daughter, her father *was* his late colleague; she herself is a skilled administrator—but it is worth a read if you like space opera or if you've run out of such goodies as the Clarke and Sheffield books.

Another high-technology space opera is Jim Hogan's **Two Faces of Tomorrow**. The premise is intriguing: the world of the future is heavily computerized—credit, traffic control, production, and all the rest—and people are adding to the computer system primitive optimization circuits. However, what the computer sees as the optimum way to do something may have sad side effects indeed, as when it removes a lunar hill in the way of a construction job by bombing it into dust with artificial meteors, narrowly missing a survey crew. The computer has no judgment, and the answer seems to be to equip it with just that commodity. But what, the decision-makers wonder, if giving the machine judgment lets it become intelligent? What if it decides its interests are not the same as humanity's?

The solution is to set up the proposed computer system in a self-contained satellite, give it a "survival instinct," challenge it with various threats to its existence, and then see what happens. Will it turn on its masters? Will its masters remain able to turn it off? Or will the computer remain benign?

The idea is fascinating, for it may well represent a future situation. But the execution is flawed in two major ways. Too much of the story is in the form of long, dreary lectures on artificial intelligence, and the story degenerates into a man vs. machine battle, ending when the computer "sees the light" and recognizes that its and its masters' interests are identical. If you are interested in artificial intelligence, by all means read the book. If you read for entertainment only, skip it.

Fred Saberhagen is dependable. His stories are always well crafted, from premises to conclusions, and his people breathe. His biggest defect is probably that his favorite villains—the Berserkers—are changeless even while he jiggers their forms and capabilities to suit individual stories. They are incarnate evil, and any change in them is no more than tactical—they remain fundamentally the same forever. This is why I, for one, am tired of Saberhagen's Berserker series. His heroes, who do change, are on stage briefly. His villain is on all the time, and the villain is monotonous.

Berserker Man is no exception to all the above. Expectably, the story is well crafted. But the story is a Berserker story. It is saved only by a feature that at first promises the final defeat of the evil machines, an ultimate development of the man-amplifiers being experimented with on Earth today. Built of energy fields in-

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stead of matter, it gives its wearer the power of flight, even faster than light. It also bestows sensory acuity beyond anything remotely human, as well as enormous strength. Conceived as a weapon for the Berserker war, it can be effectively used by no one—it is too great a strain on sanity—until its military developers find one boy on a distant planet, Michel Geulincx.

As they train Michel in how to use the device, he finds his consciousness altered. His viewpoint becomes, perhaps, less human and more universal. But his development is interrupted by his capture by a Berserker force. He then learns that his very conception was aimed at making him the ultimate in "good-life" (pro-Berserker), and that now he is supposed to switch sides. He refuses and escapes. He learns to exploit his "man-amplifier" to the fullest, and in the end he transcends both human and inhuman. The details of the end I won't divulge—not because they're so wonderful, but because I don't want to rob the story of its point.

Clearly, to anyone sick of Berserkers I'm not recommending this book. To others, who like the demons or who just don't know them yet, I am. The series, and this story, present another view of intelligent machines, and Fred tells a good story, after all. Sometimes he even deserves completely unreserved praise, as for **An Old Friend of the Family**, a Chicago vampire tale in which Vlad Tepes comes to the aid of the granddaughter of an old friend, and her children and grandchildren. There is a tribe of vampires, you see, and in Europe they have for centuries been led by the Count. Led and restrained by his sense of honor. In America—well, there's a sense of freedom and a gangster morality, a nice combination when honor is passé. There's a rebellion against the Count, and a trap baited by a tormented family. And, of course, the Count wins with the aid of his old friend's descendants. How could he not, when Fred has modelled his character on John D. Macdonald's Travis McGee? (Speaking of which, don't miss the latest McGee, *The Empty Copper Sea.)*

Michael Bishop's **Transfigurations** is an extension of his earlier novelette, "Death and Designation Among the Asadi," in which he created a marvelously alien species of questionable intelligence. The novelette ended with the vanishing of an anthropologist into his confusing subject matter. The novel carries on with the arrival of the anthropologist's daughter on the planet BoskVeld, intending to vindicate her father and his work with the aid of a crossbreed chimpanzee/baboon surgically modified to resemble the native Asadi. With her father's old partner, she succeeds, but at the cost of replacing one mystery with another. She discovers possible ancestral links between the Asadi and humans, signs of a genetically engineered escape from symbiotes reminiscent of Heinlein's *Puppet Masters,* and her father, captured by the batlike symbiotes and subjected to a reengineering designed to make him a suitable host for the symbiotes.

But none of the apparent answers are clear. Bishop has chosen a more realistic approach to providing his answers than most writers dare—there is no omniscient informant; instead,

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the characters seize on whatever clues they find and spin out elaborate hypotheses, guesses, fantasies, which are allowed to stand for answers. Granted, the hypotheses fit the data, and there are supporting clues, but nothing is definite. As a result, the novel fails to sing, often bogging down in "maybes" and "ifs." Since it is more than competently written, something we have come to expect of Bishop, and since the novel's science is a convincingly realistic application of evolutionary and neuro-biology, the failure is sad. If you stop to reflect, I think you will agree that the big sales and the prizes almost invariably go to books that "sing" to the reader in some fashion, not to plodders, however excellent they may be in other ways. What makes a story "sing"? Action, of course, and Bishop has that. Identifiable characters. Comprehensible motivations, plot, and resolution. And Bishop has all of that. But there must also, I think, be some sense of certainty to the explanations of the mysteries on which the plot hinges, and Bishop lacks that. He has my condolences.

It would be easy to go on for twice or thrice as many pages as I'm allowed. But I can't. Not only is there a limit on space, but if I write too long a column, the cost/benefit picture goes to the devil. (All contractors moan about *prix fixe* jobs.) You will therefore have to be content with a few very sketchy reviews of books that deserve some mention.

Dean Ing's **Soft Targets** is not science fiction. Or is it? It deals with a modern problem—international terrorism—and does it without positing any new technology. It does, however, propose a solution that is a classic in the "What if...?" line. What if the media started ridiculing the terrorists? The story is both excellent and gripping. Do not read it when alone.

Allen Wold's **The Planet Masters** is a fairly competent first novel. Worth a read, but no prizes, it's the story of a treasure hunter's return to the planet of his forebears, his growing involvement in its relatively savage society, and his final acceptance of the responsibility his grandfather abdicated by fleeing. It could have been better, but nevertheless it makes Allen Wold's name one to watch.

Atheneum is bringing out science fiction and fantasy under the Argo Books imprint. Ostensibly for juveniles, the titles include books which should appeal to all ages. Anne McCaffrey's **Dragondrums** is the third in her Harperhall of Pern series (sixth of the Pern books), the story of Menolly and Piemur. Anyone who has read the previous books needs no more than this as a recommendation. Patricia McKillip's **Harpist in the Wind**, third in the trilogy that began with *The Riddlemaster of Hed,* is fantasy concerned with the place of good and evil in the world. The book resolves the uncertainties and conflicts posed in the earlier stories, and it does so satisfactorily. Carl West's and Katherine MacLean's **Dark Wing** is the tale of a world in which medicine is illegal (historically, in reaction against the present inequities of distribution of medical care), a world in which a bright teenager finds an antique paramedic's kit and begins to study and use medicine, until circumstances force his abdication of responsibility.

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The ending is realistic, if aggravating.

And there are the **Chrysalis** anthologies from Zebra, edited by Roy Torgeson. I have before me numbers 3 and 4, and they are both reasonable facsimiles of magazines as far as quality of content goes. In other words, they are perfectly readable, but they contain few potential prizewinners. Since the contributors include Lafferty, Bryant, Yarbro, Monteleone, Bischoff, Bishop, Spider Robinson, and Card, among others, you can expect satisfaction. The lack of stellar material is probably due to a combination of the publisher's reputation, Torgeson's moderately low rates, and the newness of the series, all of which are subject to change.

But enough of fiction. There remain before me two excellent works of nonfiction. Jerry Grey's **Enterprise** is a history of the space shuttle and a paean to its prospects. Grey has been intimately involved in the space program for many years and is currently U.S. vice president of the International Astronautical Federation. He is therefore deeply concerned that the very compromises that let the shuttle become reality endanger its success. For a large instance, NASA had to give up its plans to develop a "space tug" that could move material from near-Earth to geosynchronous orbit. Since the shuttle is itself limited to the low orbit, and since so many of its potential applications require access to the high one, the lack of a tug may prove NASA's undoing. If a tug can be developed fairly soon, then the shuttle may make it possible for Earth to escape many of its current crises—from energy to materials to pollution. But you know that story.

A broader vision is sustained in Carl Sagan's **Broca's Brain**, subtitled "Reflections on the Romance of Science." His basic theme is that now is the best of times to be alive, when many basic questions of philosophy, religion, and science are on the verge of being answered. He stresses the need for science literacy, the exchange by scientists of their freedom of inquiry for the obligation to explain their work. He praises science in a hymn to Einstein, states his belief that the universe is knowable, and describes current history as the crossroads between doom and apotheosis, both by way of the fruits of science. He demolishes Velikovsky and other pseudoscientists, and then he admits that the old Astounding helped make him what he is. He thinks "It is no exaggeration to say that if we survive, science fiction will have made a vital contribution to the continuation and evolution of our civilization" (p. 146).

Toward the end of *Broca's Brain,* Sagan particularly pleases me by discussing the idea that God is an unnecessary hypothesis, that it makes just as much sense to say "is, was, and always will be" of the universe as it does to say it of God. This has long been a thought of my own, and this is the first time I have seen it laid out in print, and laid out well, too. He then goes on to examine the reports of people who have been revived after "clinical death"—movement toward light and a great godlike figure—and compares them with the birth experience. There are, he feels, considerable parallels, to the extent that religious feeling—and even such creation myths as the Big Bang

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theory—may be no more than a reflection of our earliest memories and yearnings. An intriguing thought.

It will surprise no one who has read any of the man's other books if I say that Sagan does all this in a superlatively readable prose framed in rigorous logic. He is a scientist, a politician of science, and not without justice is he called one of the foremost popularizers of science of our time. At the same time, he is not another Asimov, not even a better Asimov. He is more thoughtful, more philosophical, and he therefore connects the results and implications of science more deeply to human life. If we have to call him anything, we should call him a Sagan, the Sagan, and wish we had more of him. ■

It was on his fourth attempt that Isaac Intrepid finally created a viable time machine. (The first three were good for very little except cutting up Munster cheese, a fact that caused Intrepid to add immeasurably to his wealth and fame by selling first North American rights to *Intrepid's Guide to Cheese Slicing*, available in hardcover for $17.95 from Seldom House.)

Intrepid ranged throughout human history in his machine, observing the Crucifixion, correcting the spelling of the Ten Commandments, watching Babe Ruth call his shot against the Chicago Cubs, even offering Moyshe Dayan a bit of tactical advice in the Six Day War. It was illuminating for a while, but being a man of action and a man with a probing mind, he ultimately decided to come to grips with some of the more paradoxical elements in the nature of Time.

Ironically, this desire to warp the fabric of Time coincided with the news that *Intrepid's Guide to Brontosaur Teeth* would not be going into a fifth printing. Understandably depressed, the great man decided to end it all—and he quickly realized that time afforded him a unique way of so doing.

Armed with a .38-caliber Police Special (see *Intrepid's Guide to the Handguns of Lower South Mannattan, 6th Edition*), he took his machine back into the dim and distant past, to a point some eleven months before his birth. Disembarking, he moved to a place of concealment near his parents' house, waited for his father to return home from work, fired point-blank, and waited to vanish.

And, paradoxically, nothing happened.

The great man lowered his massive head in thought. He recomputed the Fitzwilliam-Goering equations, reintegrated the Steinholtz Theory of Space-Time Vectors, and even added the number of stolen bases accumulated by the 1943 St. Louis Browns. It still made no sense. If one killed one's father prior to one's own conception, then one simply ceased to exist. There was absolutely no other explanation, unless . . .

Suddenly, he straightened up.

"Oh, Mother!" cried Isaac Intrepid, tears of shame running down his face. "How could

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BRASS TACKS BRASS TACKS

Dear Analog:

It was a very joyous occasion that happened once a month. I'd run home across a field of grass pausing, occasionally, to glance up at a passing plane overhead or the evening star just becoming visible through the twilight. I was running because I knew that the publication containing John W. Campbell's latest editorial had been on the newsstand since morning and that most of my friends had probably already read it. Upon arriving at home, I ran up to my room, flung myself on the bed, and immersed my mind in the words of THE MAN.

Later, several of us would gather to discuss and marvel at the ideas within the latest editorial of J.W.C. Many magazines contained interesting editorials and stories but none brought as much joy as this one because this one made you THINK. Other magazines were just interesting and slightly entertaining. Purely passive. But this one forced you to do more than just absorb the ideas of others, it made you create ideas of your own by merely planting the seeds in your mind.

This is a description of an issue of a magazine which could have come out in the late thirties or the early seventies. This is a description of the magazine which has been at the top in the field of science fiction and scientific speculation since the late thirties. This is a description of Astounding/Analog.

The magazine has been around a little longer than that though. Fifty years ago, in January 1930, the first issue of Astounding Stories of Super Science was unleashed upon the world with little fanfare. It was a pulp in every sense of the word. Cheap paper, bug-eyed monsters, and low-quality fiction dominated the magazine until 1934. Editor, Harry Bates knew that this was what the public wanted. But it wasn't to be. In 1934 the Clayton Publishing Company folded. Astounding went down with it but wasn't to stay down for long. Street and Smith began publishing Astounding Stories later that year under new

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editor, F. Orlin Tremayne.

Tremayne began publishing what he called "Thought Variant Stories" which were a happy, but still underaged, medium between the over-adventurous stories of the old Astounding and the over-scientific stories of Hugo Gernsback's magazines.

Tremayne began publishing the tremendously popular stories of E.E. Smith and John W. Campbell (also known as Don A. Stuart). Tremayne's editorship was merely to set the stage for what was to come. In 1937, John W. Campbell became editor and, for more than thirty years, until his untimely death in 1971, inspired millions of readers and writers throughout the world. He also enabled most of the top SF writers of the past forty years to get their start. From Asimov to Pournelle

Campbell's editorials inspired countless writers and scientists alike. He was always ahead of his time which, quite frequently, made him less than popular. But most eventually came to realize that he was usually right in the long run.

Campbell was never really happy with the word Astounding so, over a period of months in 1960, the title was gradually changed to Analog.

John W. Campbell Jr., died in 1971 but his high traditions of excellence have been kept by his successor, Ben Bova, and by Analog's present editor, Dr. Stanley Schmidt.

The January 1980 issue of Analog marks the fiftieth anniversary of this publication. I sincerely hope these traditions will be kept, at least, another fifty years until all the scenes depicted in past and future issues of Astounding and Analog become reality. The fact that many already have is due to the genius of the fine editors and immortal writers who have contributed to these pages.

HAPPY BIRTHDAY ANALOG! May those not yet born experience an Analog Day every month the way I have. May Analog continue to open and expand minds the way it did mine.

JAMES J.J. WILSON
21 Spinning Wheel Rd.
Hinsdale, IL 60521

And thank you for writing. We're looking forward to at least another fifty years of doing just that.

Dear Sir:

I read with great interest your March issue and was particularly disturbed by the article "Funding the Future," by M. David Stone and its exposure of the politics of fraud used by some members of Congress. Even more disturbing is a parallel between the disparaging of some basic research and its tendency to haunt the descendants of those who ridicule it.

An example:

"...Goddard's 'useless' work on rockets."

How useless was this research to the residents of London in 1944-45 when large parts of their city were shattered by the V-1, the children of Goddard's "useless" rockets?

How useless is this research to us today when thousands of the great-grandchildren of Goddard's "useless" rocket slumbering in silos threaten every man, woman, and child on this planet?

What is my point?

Basic research is the foundation for tomorrow's miracle cure (e.g., polio

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then, cancer tomorrow?), but it is also tomorrow's successor to the caveman's club. The thing may be shiny, with a longer reach, maybe even beautiful in its own way, but it is still deadly. If we, the people, *allow* a politician to score press points by sharpshooting basic research, we may not have a Congress or the press or even researchers for the politicians to ridicule.

I don't know who said it, but I agree with it wholeheartedly: "What you don't know won't hurt you, it will kill you."

DONALD L. RITCHEY
1627 Front Street Apt. 2
Oceano, CA 93445

Or, at the very least, it may.

Dear Stanley,

I assume it was Ben Bova who wrote the editorial and response to the letter by Alexander Doniphan Wallace, but whoever it was, I think he misunderstood what Mr. Wallace meant by saying teachers should let the student lead in the educational process. To my mind, his was a very perceptive analysis of where modern educational methodology is errant.

In our current mass-production, assembly-line approach to education, we have teachers who simply lecture and then give tests to see how well the students remember what they said. That is not education, it is indoctrination! No matter if the facts are true—it is still indoctrination, not education.

Education means developing the human mind so that it realizes its full intellectual potential. This cannot be accomplished by merely lecturing and giving tests for memory.

The way to do it—and I believe this is what Mr. Wallace was getting at—is to encourage the students to think and inquire, to reach out with their own minds in an effort to learn *actively*, rather than passively accept being spoon-fed facts. Ask the students why. Why whatever is being discussed happened or is true. Why did Hitler arise? Was it the result of a general drift to the right, a return to conservative traditions, a reassertion of a people's fundamental ethnicity in the face of adversity? Might there be a similar danger today when people think the proper response to adversity is to return to conservative traditions and reassert their fundamental ethnicity? What do the *students* think? The teacher should help them think, not tell them what to think. In this, it is the students who should lead.

Teachers, of course, should supply facts as needed. Also they should give instruction in how to use the mind, explaining the nature of analogies and how to use them in reasoning, and how analogies can be deceiving. Logic should be a universal requirement, and it should be taught in first grade.

Now I am going to go a bit further. I believe that when force-feeding facts is all the teaching teachers do, they are depriving the young, growing minds of students of what they really need, and may actually cause serious damage resulting in lifelong mental impairment. I believe that all normal human beings are born with the capacity for genius, and it is the stunting, stultifying, molding effects of current educational methodology that reduce the vast majority to what we call "average."

Consider the common experience

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of educators involved in special programs for problem students. Encouraged to take initiative and reach out with their own minds for learning, the problem students typically blossom, become sponges for knowledge, and display surprising perceptivity and previously unsuspected talents. What we should see is that *all* the students in our schools are the same as the problem students. The problem students are simply the ones who try to resist the crushing, smothering, molding effects of the form of education inflicted on them. Perhaps they become frustrated at the futility of resisting, and simply give up in bitter despair. Perhaps they angrily rebel against the establishment that is abusing their minds. But they are reacting against something that also affects the nonproblem students just as much.

Consider also the example of Edith Stern, whose father deliberately set out to make a genius of her. He filled her environment from infancy with intellectual stimulants, and he personally guided her in developing her mind for herself aside from and in spite of her schoolwork. She developed an I.Q. of 200, and at the age of 16 became an instructor in advanced calculus at Michigan State University. Her siblings, who were not raised the same way because of the mother's interference, turned out to be average.

I could go on and on about this. Suffice to say, I believe most of us do not even suspect the true enormity of the harm we are doing to the human race by the destructive methods that we use to "educate" our young.

RONALD R. LAMBERT

I agree with much of what you say, but there are many times when the teacher must *lead, simply because there are too many paths to try for the students to get very far on any of them without some guidance as to which ones to choose at the branches. As a colleague of mine once observed in response to a suggestion of a completely unstructured lab, "You know, people had glass for an awfully long time before they figured out the telescope." A teacher, among other things, tries to help an individual acquire something that took his ancestors many generations of combined effort—and that does indeed take leadership. But there are many ways to provide it, and in my experience "leading questions" are usually one of the best. A good teacher must also know how to follow good leading questions when they come from the students—probably one of the hardest (and most important) skills of teaching is, in fact, knowing when to lead and when to follow. Probably the most successful course I ever taught, in at least some ways, was the science fiction course for which this rapid alternation of leading and following was the lifeblood. I always came to class with questions of my own to get things started in directions I thought worth exploring, but I was never sure at the beginning of a class where we'd be by the end. Some subjects lend themselves more readily to that than others, though—there are some territories any teacher of sophomore physicists had better be sure they've seen before they become juniors. But in all of my most satisfying teaching, whatever the subject or format, I've had the feeling that teacher and students were constantly pulling* each other *forward.*

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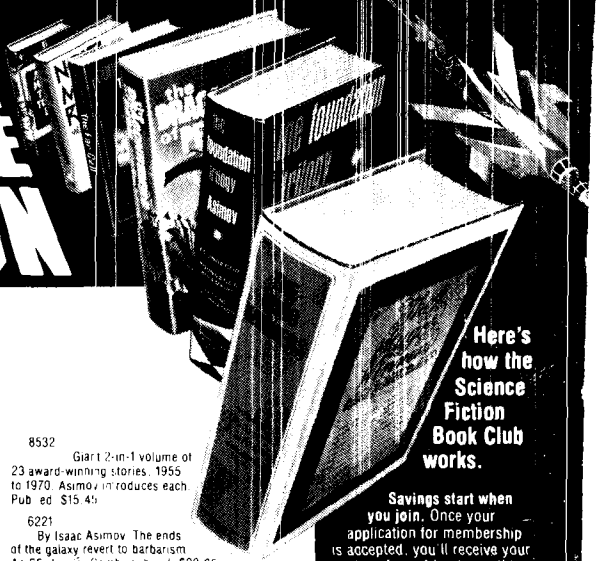

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